1701MA101	ENGINEERING MATHEMATICS I (Common to all B.E / B.Tech Degree Programmes)	L 3	T 2	P 0	C 4

COURSE OBJECTIVES:

1. To educate Matrix Algebra Technique and curvature Theory
2. To impart knowledge of Techniques in solving Ordinary Differential Equations and to apply in solving Modern Engineering Problems
3. To acquaint the students about functions of several variables and also to familiarize the students in infinite series and their convergence

UNIT I EIGEN VALUE PROBLEMS **9 Hours**

Characteristic equation - Eigen values and Eigen vectors of a real matrix – Properties - Cayley– Hamilton theorem- Diagonalization of Matrices - Reduction of a quadratic form to a canonical form by orthogonal transformation – Application of Matrices in Structural Engineering and image processing

UNIT II ORDINARY DIFFERENTIAL EQUATIONS **9 Hours**

Higher order linear differential equations with constant coefficients – Cauchy‟s and Legendre‟s linear equations – Method of variation of parameters in solution of ordinary differential equations.

UNIT III DIFFERENTIATION AND GEOMETRICAL APPLICATIONS **9 Hours**

Derivative of special functions (Trigonometry, Exponential, Logarithmic), Derivative by rule (Product, Quotient, Chain rule), Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature- Evolutes and involutes.

UNIT IV MULTIVARIABLE CALCULUS **9 Hours**

Functions of two variables and solutions(Partial derivatives and Euler‟s theorem)– Taylor‟s series - Maxima and Minima – Application of Partial Derivatives to find the optimum requirement using Lagrangian multipliers.

UNIT V SEQUENCES AND SERIES **9 Hours**

Sequences: Definition and examples – Series: Types and Convergence – Series of positive terms – Tests of convergence: Comparison test, Integral test and D‟Alembert‟s ratio test – Alternating series – Leibnitz‟s test – Application of Sequences in real life.

TOTAL: 45 + 15 HOURS

FURTHER READING:

1. Modeling and solutions using Newton‟s Law of Cooling of Bodies
2. Differentiation of implicit Functions, Jacobians and Properties

COURSE OUTCOMES:

On the Successful completion of the course, Students will be able to

CO1: Analyze the characteristics of a linear system with Eigen value and Eigen Vectors
CO2: Recognize and solve Higher order Ordinary Differential Equations
CO3: Solve Derivative of special functions and apply it in solving Geometrical problems
CO4: Apply Partial Derivatives in finding Maxima and Minima of a function
CO5: Test the convergence of any series

REFERENCES:

1. Veerarajan R., “Engineering Mathematics”, updated second edition for semester I and II,(2017)
2. Grewal. B.S, “Higher Engineering Mathematics”, 44th Edition, Khanna Publications, Delhi, (2014).
3. Bali N. P and Manish Goyal, “Text book of Engineering Mathematics”, Sixth edition, Laxmi Publications(p) Ltd.,(2014).
4. Glyn James, “Advanced Modern Engineering Mathematics”, 3rd Edition, Pearson Education, (2012).
5. P.Kandasamy, K. Gunavathy and K. Thilagavathy, Engineering Mathematics ,Volume II, S. Chand & Co ., New Delhi, (2009)
6. Erwin Kreyszig, Advanced Engineering Mathematics,9th Edition, Wiley International edition, (2006)
7. Ramana B.V, “Higher Engineering Mathematics”,Tata McGrawHill Publishing, New Delhi, (2007).
8. M K Venkataraman, Engineering mathematics, Volume I, 2nd ed., National Publishing Co.(2003)
9. nptel.ac.in/courses/111105035, www.nptelvideos.in/2012/11/Mathematics.html
10. www.learnerstv.com/Free-maths-video lectures - ltv348-page1.htm

1701PH101	APPLIED PHYSICS FOR ENGINEERS	L	T	P	C
	(Common to all B.E. / B.Tech Degree Programmes)	3	0	0	3

COURSE OBJECTIVES:

1. To impart knowledge in properties of matter, crystallography and ultrasonics.
2. To understand the applications of lasers and fiber optics.
3. To implement the principles of quantum physics in the respective engineering fields.

UNIT I PROPERTIES OF MATTER **9 Hours**

Elasticity: elastic and plastic materials – Hooke‟s law – elastic behavior of a material – stress – strain diagram – factors affecting elasticity. Three moduli of elasticity – Poisson‟s ratio – torsional pendulum – twisting couple on a cylinder. Young‟s modulus – uniform bending – non-uniform bending. Viscosity: coefficient of viscosity – streamline and turbulent flow – experimental determination of viscosity of a liquid – Poiseuille‟s method.

UNIT II APPLIED OPTICS **9 Hours**

Interference: air wedge – theory – uses – testing of flat surfaces – thickness of a thin wire. Laser: introduction – principle of laser – characteristics of laser light– types: CO2 laser – semiconductor laser (homojunction). Fiber optics: principle of light transmission through fiber – expression for acceptance angle and numerical aperture – types of optical fibers (refractive index profile and modes) – fiber optic communication system (block diagram & description).

UNIT III ULTRASONICS **9 Hours**

Ultrasonics: introduction – properties of ultrasonic waves – generation of ultrasonic waves – magnetostriction - piezo electric methods – detection of ultrasonic waves – Determination of velocity of ultrasonic waves (acoustic grating). Applications of ultrasonic waves: pulse echo method, SONAR – measurement of velocity of blood flow – modes of operation (A scan, B Scan & C Scan).

UNIT IV SOLID STATE PHYSICS **9 Hours**

Crystal Physics: lattice – unit cell – crystal systems – Bravais lattices – Miller indices – ”d‟ spacing in cubic lattice – calculation of number of atoms per unit cell, atomic radius, coordination number and determination of packing density for SC, BCC, FCC and HCP structures – X-ray diffraction: Laue‟s method – powder crystal method.

UNIT V QUANTUM MECHANICS **9 Hours**

Quantum Physics: development of quantum theory – de Broglie wavelength – Schrodinger‟s wave equation – time dependent and time independent wave equations – physical significance. Application: particle in a box (1D) – degenerate and non-degenerate states. Electron Microscopy-SEM, TEM - principle and working – problem solving.

TOTAL: 45 HOURS

FURTHER READING:

Neutrino‟s – expanding universe

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1: Realize the concept of properties of matter and apply the same for practical applications.
CO2: Identify the suitable laser source for fiber optic communication applications.
CO3: Determine the velocity of ultrasonic waves and apply the same for day today applications.
CO4: Classify the different types of crystal structures and analyze their properties.
CO5: Comprehend the efficacy of quantum equations in modern areas.

REFERENCES:

1. D.S.Mathur, Elements of Properties of matter, 5th edition, S.Chand & Company Ltd., New Delhi,2012.
2. Charles Kittel, Introduction to Solid State Physics, 8th edition, Wiley India Pvt. Ltd., New Delhi, 2012
3.Arthur Beiser, Shobhit Mahajan and S. Rai Choudhury, Concepts of Modern Physics, 6th edition, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2010.
4. B.K. Pandey and S. Chaturvedi, Engineering Physics, 1st edition, Cengage Learning India Pvt. Ltd., New Delhi, 2012.
5. Halliday and Resnick, Fundamentals of Physics, John Wiley and Sons, Inc, 2011.
6. Ian Morison, Introduction to Astronomy and Cosmology, John Wiley and Sons, Ltd, 2013.
7. http://nptel.ac.in/

1701EN101 **TECHNICAL ENGLISH** **L T P C**
(Common to all B.E / B.Tech Degree Programmes) **3 0 0 3**

COURSE OBJECTIVES:

1.To develop the ability to read and comprehend technical texts in the field of Engineering
2.To develop vocabulary building through the study of word construction
3. To develop ability to write formal definitions of technical terms and expression.
4. To recognize various grammatical structures that will aid the student improve his/her theoretical knowledge.

UNIT I **9 Hours**

Articles-Preposition-Subject-Verb-Object-Adjective-Adverb-Conjunction-Nouns- Usages of Have, has, had-Simple Present-Simple Past-Simple Future-Self introduction-Framing Questions

UNIT II **9 Hours**

Present Continuous-Past Continuous-Future Continuous-Describing a place, person or thing-Framing negative questions-Gerund-Listening to Articles, speeches and audios

UNIT III **9 Hours**

Present perfect-past perfect-future perfect-writing short paragraph-sentence pattern- Infinitive-Tag questions-Reading newspaper cutting

UNIT IV **9 Hours**

Present perfect continuous –Past perfect continuous-Future perfect continuous-writing an Essay in 100 words-Types of sentences-Prefix-suffix-word formation-Dialogue writing.

UNIT V **9 Hours**

Active voice-passive voice-impersonal passive voice –Synonyms and Antonyms-phrasal verbs- Punctuation-Common Errors-Letter writing.

TOTAL: 45 HOURS

FURTHER READING:

Letters from a Father to His Daughter- Jawaharlal Nehru

COURSE OUTCOMES:

On the successful completion of the course, Students will be able to

CO1: Read and comprehend technical texts in the field of Engineering
CO2: Acquire vocabulary building and write effectively in technical writing
CO3: Write formal definitions of technical terms and expression in both verbal and written form.
CO4: Understand grammatical structures and use flawless English in the professional documents

REFERENCES:

1. Meenakshi Raman, Sangeetha Sharma, "***Technical Communication : English Skills for Engineers"*** Oxford University Press: New Delhi, 2016.
2. Rizvi Ashrav.M, "***Effective Technical Communication***" Tata McGraw Hill: New Delhi, 2017
3. Herbert, A.J, "***Structure of Technical English***", London English Language Society. https://archive.org/details/in.ernet.dli.2015.136456
4. J.D. O'Connor, Better ***English Pronunciation*** Paperback, 2nd edition, 162 pages, Published September 16th 2013 by Cambridge University Press,October 23rd 1967
5. Nehru, Jawaharlal. ***Letters from a Father to His Daughter***, Puffin Books, 2004
6. ***Technical English*** by faculty of English –published by EGS Pillay press 2017

1701CH104	APPLIED CHEMISTRY	L	T	P	C
	(Common to B.E. – ECE & EEE Programmes)	3	0	0	3

COURSE OBJECTIVES:

1. Recall the terminologies of electrochemistry and explain the function of batteries and fuel cells
2. Choose appropriate instrumentation technique for interpreting analytical data.
3. Understand the fundamentals of corrosion, its types and polymers with its applications with its electrochemical reactions

UNIT I ELECTROCHEMISTRY **9 Hours**

Cell terminology-Electrochemical cells- Electrolytic cells- Cell reactions- Daniel cell-Difference between electrolytic cells and electrochemical cells. Reversible cells and irreversible cells -types- EMF series and its applications - Nernst equation (derivation and problems).Single electrode potential - Hydrogen electrode - Calomel electrode - Glass electrode - pH measurement using glass electrode.

UNIT II CORROSION AND ITS CONTROL **9 Hours**

Corrosion – types-chemical, electrochemical corrosion (galvanic, differential aeration) - Factors influencing corrosion -corrosion control – material selection and design aspects - electrochemical protection – sacrificial anode method and impressed current cathodic method. Protective coatings: Electroplating of gold and electroless plating of nickel. Paints - Constituents and Functions.

UNIT III NONCONVENTIONAL ENERGY RESOURCES AND STORAGE DEVICES **9 Hours**

Introduction- nuclear energy- nuclear fission, nuclear fusion- nuclear chain reactions- breeder reactor- Nuclear Reactor-solar energy conversion- solar cells- wind energy. Batteries and fuel cells: Types of batteries- alkaline battery- lead storage battery nickel- cadmium battery- lithium battery- fuel cell H2 -O2 fuel cell- applications

UNIT IV POLYMER AND ITS APPLICATION **9 Hours**

Introduction: Classification of polymers – Natural and synthetic; Thermoplastic and Thermosetting. Functionality – Degree of polymerization. Addition (Free Radical Mechanism) condensation and copolymerization. Fabrication of Plastics. Application –Conducting polymer.

UNIT V INSTRUMENTAL TECHNIQUES OF CHEMICAL ANALYSIS **9 Hours**

Laws of photochemistry - Grothus–Draper law, Stark–Einstein law and Lambert-Beer Law. Electromagnetic spectrum - UV-visible and IR spectroscopy – principles, instrumentation (Block diagram only) - Applications. Colorimetry- principles, instrumentation (Block diagram only) estimation of iron. Flame photometry – principles, instrumentation (Block diagram only) estimation of sodium.

TOTAL: 45 HOURS

FURTHER READING:

1. Alloys-ferrous and nonferrous alloys
2. Cambridge structural database (protein data bank)-noting data bank
3. Unique properties of nano material- introduction to quantum materials, quantum dots, supramolecular materials and molecular crystal engineering – molecular machines and devices-Logic gate using electronics material for molecular electronic.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1: Construct an electrochemical cell and measure its potential
CO2: Identify the components and processes in batteries and infer the selection criteria for commercial battery systems with respect to different applications
CO3: Utilize electrochemical data to formulate an electrochemical half-cell and cell reactions for corrosion control processes
CO4: Differentiate the polymers used in day to day life based on its source, properties and applications
CO5: Identify the applications of analytical methods for the estimation of elements in aqueous media

REFERENCES:

1. Ashima Srivastava and Janhavi N N., "Concepts of Engineering Chemistry", ACME Learning Private Limited., New Delhi, 2010.
2. Ravikrishnan A., "Engineering Chemistry", Sri Krishna Hi-tech Publishing Company Pvt. Ltd. Chennai, 2016.
3. RenuBapna and Renu Gupta., "Engineering Chemistry", Macmillan India Publisher Pvt Ltd, 2010.
4. Willard Merritt and Dean Settle, Instrumental methods of analysis, CBS publishers, Seventh edition, 2012.
5. DaraS.S, Umare S.S."Engineering Chemistry", S. Chand & Company Ltd., New Delhi., 2010.
6. https://www.ccdc.cam.ac.uk/solutions/csd-system/components/csd/
7. https://link.springer.com/chapter/10.1007/978-3-642-28030-6_2
8. www.santarosa.edu/~yataiiya/4D/QuantumDotsMk2.ppt
9. onlinelibrary.wiley.com/doi/10.1002/9780470661345.smc107/pods

10. https://en.wikipedia.org/wiki/Molecular_electronics.
11. Jain and Jain, "Engineering Chemistry", Sixteenth edition, Dhanpatrai publications, 2012.

1701GE102	BASIC CIVIL ENGINEERING	L	T	P	C
	(B.E – Electrical and Electronics Engineering)	3	0	0	3

COURSE OBJECTIVES:

4. To educate students about basic surveying
5. To impart knowledge about the building materials, foundations and superstructures
6. To impart knowledge about the solid mechanics and fluid properties

UNIT I GENERAL & BASICS OF SURVEYING **9 Hours**

General introduction to Civil Engineering - types of buildings - Surveying – Principles, Objectives, Horizontal measurements with chain and tapes, Ranging; Levelling – Instruments, Reduction of levels; Modern surveying instruments.

UNIT II BUILDING MATERIALS **9 Hours**

Building materials – Stones, Bricks, Sand, Cement, Cement mortar, Cement concrete, Steel, Timber, Decorative finishes, Paints.

UNIT III FOUNDATIONS & SUPERSTRUCTURE **9 Hours**

Foundations: Types, Bearing capacity – Requirement of good foundations. Superstructure: Brick masonry – stone masonry – beams – columns – lintels – roofing – flooring – plastering.

UNIT IV BASICS OF SOLID MECHANICS **9 Hours**

Stress and strain at a point – Tension, Compression, Shear Stress – Hooke‟s Law – Relationship among elastic constants – Ultimate Stress – Yield Stress – Factor of Safety- beams and bending – types of loads-methods of joints – method of sections.

UNIT V FLUID PROPERTIES **9 Hours**

Fluid – definition, distinction between solid and fluid - Units and dimensions - Properties of fluids - density, specific weight, specific volume, specific gravity, temperature, viscosity, compressibility, vapour pressure, capillarity and surface tension.

TOTAL: 45 HOURS

FURTHER READING:

The testing methods of materials and applications of solids and fluids.

COURSE OUTCOMES:

On the successful completion of the course, Students will be able to

CO1: Realize the concepts of basic surveying
CO2: Select & utilize the suitable building materials
CO3: Demonstrate the classifications of foundation and superstructures
CO4: Explain the properties of solids
CO5: Explain the properties of fluids

REFERENCES:

1. Ramamrutham S., "Basic Civil Engineering", DhanpatRai Publishing Co. (P) Ltd. (1999).
2. S. Rajput, Strength of Materials, S. Chand & Co., 2006
3. R. K. Bansal, Fluid Mechanics and Hydraulic Machines, Laxmi Publications, New Delhi, 2005
4. S. K. Duggal, Building Materials, New Age International (P) Ltd., 2003
5. Seetharaman S., "Basic Civil Engineering", Anuradha Agencies, (2005).
6. Shanmugam G and Palanichamy M S, "Basic Civil and Mechanical Engineering", TataMcGraw Hill Publishing Co., New Delhi, (1996).
7. http://nptel.ac.in/

1701GE103 **BASIC MECHANICAL ENGINEERING** **L T P C**
(B.E - EEE Programme) **3 0 0 3**

COURSE OBJECTIVES:

1. To impart basic knowledge on Mechanical Engineering.
2. To explain the component of power plant units and detailed explanation to IC engines their working principles.
3. To explain the R & AC system.
4. To explain the system of forces and free body diagram.
5. To study about the manufacturing process.

UNIT I POWER PLANT ENGINEERING **9 Hours**

Introduction, Classification of Power Plants – Working principle of steam, Gas, Diesel, Hydro-electric and Nuclear Power plants – Merits and Demerits – Pumps and turbines – working principle of Reciprocating pumps (single acting and double acting) – Centrifugal Pump.

UNIT II IC ENGINES **9 Hours**

Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines – Boiler as a power plant.

UNIT III REFRIGERATION AND AIR CONDITIONING SYSTEM **9 Hours**

Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system – Layout of typical domestic refrigerator – Window and Split type room Air conditioner.

UNIT IV BASIC CONCEPTS AND FORCE SYSTEM **9 Hours**

Introduction to mechanics - idealization of mechanics - laws of mechanics - principle of transmissibility - vector - addition, subtraction and product. Force- types - system of forces - resultant forces - composition of forces - resolution of force-free body diagram for real world systems.

UNIT V MANUFACTURING PROCESSES **9 Hours**

Basic Concepts, Demonstration, measurement and experiments: Turning, facing, drilling, internal and external thread cutting, boring, grooving, tapper turning in lathe. Milling using end milling cutters. drilling using universal drilling machine -sheet metal spinning, deep drawing, forging of clay models, making water tank using FRP, sheet metal work-arc welding, brazing, riveting -investment casting, sand casting, injection molding, vacuum molding, blow molding -powder coating.

FURTHER READING:

Water Supply and Transportation Systems - Engineering Materials and Manufacturing Processes

TOTAL: 45 HOURS

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1: Identify the components use in power plant cycle.
CO2: Demonstrate working principles of petrol and diesel engine.
CO3: Explain the components of refrigeration and Air conditioning cycle.
CO4: Explain the force system and free body diagram.
CO5: Explain the manufacturing process.

REFERENCES:

1. Venugopal K. and Prahu Raja V., “Basic Mechanical Engineering”, Anuradha Publishers,Kumbakonam, 2000.
2. Shantha Kumar S R J., “Basic Mechanical Engineering”, Hi-tech Publications, Mayiladuthurai,2000.
3. F.P. Beer, and Jr. E.R Johnston, Vector Mechanics for Engineers - Statics and Dynamics, Tata McGraw-Hill Publishing Company, New Delhi, 2007.
4. Roger Timing, Engineering Fundamentals, Newnes, 2002.
5. C. F. Geraldand P. O. Wheatley, Applied Numerical Analysis, Pearson Education 2003.

1701HS151	PHYSICS AND CHEMISTRY LABORATORY-I	L	T	P	C
	(Common to all B.E. / B.Tech Degree Programmes)	0	0	2	1

COURSE OBJECTIVES:

1. The Objective of this course is to make the students gain practical knowledge to co-relate with the theoretical studies
2. To achieve perfectness in experimental skills
3. To bring confidence and ability to develop and fabricate engineering and technical equipments.
4. To train the students to analyses the water sample
5. To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis

PHYSICS

LIST OF EXPERIMENTS:

1. Determine the moment of inertia of the disc and calculate the rigidity modulus of a given wire using torsion pendulum (symmetrical masses method).
2. Find the elevation of the given wooden beam at the midpoint by loading at the ends and hence calculate the Young‟s modulus of the material by uniform bending.
3. Determine the coefficient of viscosity of the given liquid by Poiseulle‟s method.
4. From the interference fringes from the air wedge setup and calculate the thickness of the given wire.
5. By applying the principle of diffraction, determine the wavelength of given laser light and the average particle size of lycopodium powder using laser source.
6. Determine the
   (i) Wavelength of ultrasonic in a liquid medium
   (ii) Velocity of ultrasonic waves in the given liquid
   (iii) Compressibility of the given liquid using ultrasonic interferometer.

CHEMISTRY

LIST OF EXPERIMENTS:

1. Determination of total, temporary & permanent hardness of water by EDTA method
2. Determination of strength of given hydrochloric acid using pH meter
3. Estimation of iron content of the given solution using potentiometer
4. Estimation of sodium present in water using flame photometer
5. Corrosion experiment – weight loss method
6. Determination of molecular weight of a polymer by viscometry method
7. Conductometric titration of strong acid Vs strong Base

TOTAL: 45 HOURS

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1: Realize the concept of properties of matter and apply the same for practical applications.
CO2: Identify the suitable laser source for fiber optic communication applications.
CO3: Determine the velocity of ultrasonic waves and apply the same for day today applications.
CO4: Classify the different types of crystal structures and analyze their properties.
CO5: Comprehend the efficacy of quantum equations in modern areas.
CO6: Identify the pH of the solution.
CO7: Find the iron content of the water sample using potentiometer.
CO8: Explain and demonstrate the conductance of the solution.
CO9: Interpret the hardness and metal ions present in the water.

REFERENCES:

1. D.S.Mathur, Elements of Properties of matter, 5th edition, S.Chand & Company Ltd., New Delhi,2012.
2. Charles Kittel, Introduction to Solid State Physics, 8th edition, Wiley India Pvt. Ltd., New Delhi, 2012.
3. Arthur Beiser, Shobhit Mahajan and S. Rai Choudhury, Concepts of Modern Physics, 6th edition, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2010.
4. B.K. Pandey and S. Chaturvedi, Engineering Physics, 1st edition, Cengage Learning India Pvt. Ltd., New Delhi, 2012.
5. Halliday and Resnick, Fundamentals of Physics, John Wiley and Sons, Inc, 2011.
6. Ian Morison, Introduction to Astronomy and Cosmology, John Wiley and Sons, Ltd, 2013.
7. Daniel R. Palleros, “Experimental organic chemistry” John Wiley & Sons, Inc., New Yor (2001).
8. Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R., “Vogel‟s Textbook of practical organic chemistry”, LBS Singapore (1994).
9. Jeffery G.H., Bassett J., Mendham J.and Denny vogel‟s R.C, “Text book of quantitative analysis chemical analysis”, ELBS 5th Edn. Longman, Singapore publishers, Singapore, 1996.
10. Kolthoff I.M., Sandell E.B. et al. “Quantitative chemical analysis”, Mcmillan, Madras 1980.

1701GEX52	COMMUNICATION SKILLS LAB (Common to all B.E. / B.Tech Degree Programmes)	L 0	T 0	P 2	C 1

COURSE OBJECTIVES:

This Lab focuses on using multi-media instruction for language development to meet the following targets:

1. To improve the students‟ fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts
2. Further, they would be required to communicate their ideas relevantly and coherently in writing.
3. To prepare all the students for their placements.

LIST OF EXPERIMENTS: The following course content to conduct the activities is prescribed for the Communication Skills Lab:

1. **Activities on Fundamentals of Inter-personal Communication and Building Vocabulary** - Starting a conversation - responding appropriately and relevantly - using the right body language - Role Play in different situations & Discourse Skills- using visuals - Synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, study of word origin, business vocabulary, analogy, idioms and phrases, collocations & usage of vocabulary.
2. **Activities on Reading Comprehension** - General Vs Local comprehension, reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading & effective googling.
3. **Activities on Writing Skills** - Structure and presentation of different types of writing - letter writing/ Resume writing/ e-correspondence/ Technical report writing/ Portfolio writing - planning for writing - improving one's writing.
4. **Activities on Presentation Skills** - Oral presentations (individual and group) through JAM sessions / seminars / PPTs and written presentations through posters/ projects/ reports/ e-mails/ assignments etc.
5. **Activities on Group Discussion and Interview Skills** - Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation- Concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele-conference & video-conferencing and Mock Interviews.

TOTAL: 30 HOURS

ADDITIONAL EXPERIMENTS:

Phonetics

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1: Accomplishment of sound vocabulary and its proper use contextually.
CO2: Flair in Writing and felicity in written expression
CO3: Enhanced job prospects.
CO4: Effective Speaking Abilities.

REFERENCES:

1. Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford University Press 2009
2. Advanced Communication Skills Laboratory Manual by Sudha Rani, D, Pearson Education 2011.
3. Technical Communication by Paul V. Anderson, 2007. Cengage Learning pvt. Ltd. New Delhi
4. English Vocabulary in Use series, Cambridge University Press 2008.
5. Management Shapers Series by Universities Press (India) Pvt Ltd., Himayatnagar, Hyderabad 2008.
6. English for Technical Communication for Engineering Students, Aysha Vishwamohan, Tata Mc Graw Hill 2009.
7. Books on TOFEL/ GRE/ GMAT/ CAT/ IELTS by Barron's/ DELTA/ Cambridge University Press.

1701GEX53	WORKSHOP PRACTICE	L	T	P	C
	(Common to all B.E. / B.Tech Degree Programmes)	0	0	2	1

COURSE OBJECTIVES:

1. To provide hands on training for fabrication of components using sheet metal and welding equipment / tools.
2. To develop skill for using carpentry and fitting tools to make simple components and metal joints.
3. To provide hands on training for preparing the green sand mould using foundry tools.
4. To provide training for making simple house hold electrical & pipe line connections using suitable tools.
5. To develop the skill to make / operate/utilize the simple engineering components.

LIST OF EXPERIMENTS

1. Forming of simple object in sheet metal using suitable tools (Example: Dust Pan / Soap Box) (or) making simple object using Metal Spinning Machine. (Example: Aluminum Cup). **4 Hours**
2. Prepare V (or) Half round (or) Square (or) Dovetail joint from the given mild Steel flat. **4 Hours**
3. Fabrication of a simple component using thin and thick plates. (Example: Book rack) **2 Hours**
4. Making a simple component using carpentry power tools. (Example: Electrical switch Box/Tool box/ Letter box. **2 Hours**
5. Construct a household pipe line connections using pipes, Tee joint, Four way joint, elbow, union, bend, Gate way and Taps (or) Construct a pipe connections of house application centrifugal pump using pipes, bend, gate valve, flanges and foot valve. **4 Hours**
6. Prepare a green sand mould using solid pattern/split pattern. **4 Hours**
7. Study of gas welding equipment and its demonstration **2 Hours**
8. Soldering Practice for simple printed circuit board. **4 Hours**
9. Construct a domestic electrical wire connections using indicator, one way switch with calling bell, two way switch with lamp, one way switch with fan regulator and one way switch with socket. **4 Hours**

TOTAL: 30 HOURS

1701MA201	ENGINEERING MATHEMATICS II	L	T	P	C
	(Common to all B.E / B.Tech Degree Programmes)	3	2	0	4

COURSE OBJECTIVES:

1. To develop an understanding of the standard techniques of Complex variable theory to apply in areas such as heat conduction, elasticity, fluid Dynamics and flow of electric current
2. To train the students with the concepts of Vector calculus needed for problems in all Engineering Disciplines
3. To make the Students apply Laplace Transform to create a new domain in which it is easier to handle the problem that is being investigated

UNIT I ANALYTIC FUNCTIONS **9 Hours**

Analytic functions – Cauchy Riemann Equations – Properties – Determination of Analytic function using Milne Thomson‟s method, Conformal Mappings – Mappings of w= z + a, az, 1/z – Bilinear Transformation – Application of Analytic Functions.

UNIT II COMPLEX INTEGRATION **9 Hours**

Cauchy‟s fundamental theorem (statement only) – Application of Cauchy‟s Integral formula – Laurent‟s series – Classification of singularities – Cauchy‟s Residue theorem (statement only) – Contour integration.

UNIT III MULTIPLE INTEGRAL **9 Hours**

Double integration – Cartesian and polar coordinates – Change the order of Integration – Applications: Area of a curved surface using double integral – Triple integration in Cartesian co-ordinates – Volume as triple integral.

UNIT IV VECTOR CALCULUS **9 Hours**

Gradient, Divergence and Curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration: Green‟s theorem in a plane, Gauss divergence theorem and Stokes‟ theorem (excluding proofs) – Applications of the above theorems to find surface area of a closed region and volume of cube and parallel piped.

UNIT V LAPLACE TRANSFORM **9 Hours**

Laplace Transform – Conditions for existence – Transform of Elementary Functions – Basic Properties – Transform of Unit step function and Impulse function – Transform of Periodic function – Inverse Laplace Transform – Convolution Theorem (excluding Proof) – Initial and Final value Theorems – Solution of Linear ODE of Second order with constant coefficient using Laplace Transform techniques.

TOTAL: 45 + 15 HOURS

FURTHER READING:

1. Volume of Cylindrical and spherical polar co ordinates.
2. Application of Integral theorems in finding Volume/Area of Hemispheres, cylinders etc.

COURSE OUTCOMES:

On the Successful completion of the course, Students will be able to

CO1: Construct Analytic functions and trace the image of a region using transformation.
CO2: Solve complex integrals.
CO3: Apply multiple integral technique to find area and volume.
CO4: Compute surface and volume integral in vector field.
CO5: Apply Laplace Transform in solving Boundary value problems of second order ODE.

REFERENCES:

1. Veerarajan R., “Engineering Mathematics”, updated second edition for Semester I and II, 2017.
2. Grewal. B.S, “Higher Engineering Mathematics”, 44th Edition, Khanna Publications, Delhi, 2014.
3. Bali N. P and Manish Goyal, “Text book of Engineering Mathematics”, Sixth edition, Laxmi Publications Pvt. Ltd., 2014.
4. Glyn James, “Advanced Modern Engineering Mathematics”, 3rd Edition, Pearson Education, 2012.
5. P.Kandasamy, K. Gunavathy and K. Thilagavathy, Engineering Mathematics, Volume II, S. Chand & Co., New Delhi, 2009.
6. Ramana B.V, “Higher Engineering Mathematics”, Tata McGraw Hill Publishing, New Delhi, 2007.
7. Veerarajan R., “Engineering Mathematics”, fifth Edition, Tata Mc Graw Hill Publishing Company, New Delhi, 2006.
8. M K Venkataraman, Engineering mathematics, Volume I, 2nd ed., National Publishing Co. 2003.
9. nptel.ac.in/courses/111105035, www.nptelvideos.in/2012/11/Mathematics.html
10. www.learnerstv.com/Free-maths-video lectures - ltv348-page1.htm

1701PH202 **SEMICONDUCTOR PHYSICS AND DEVICES** **L T P C**
(Common to B.E. - ECE & EEE Programmes) **3 0 0 3**

COURSE OBJECTIVES:

1. To explain the properties of conducting, semiconducting and dielectric materials
2. To understand the working mechanism of junction diodes
3. To impart knowledge in optical and magnetic materials

UNIT I QUANTUM THEORY OF SOLIDS **9 Hours**

Emission of electron: types of thermionic emission – principle – Richardson equation – secondary emission – principle – work function – Fermi-Dirac distribution function and its temperature dependence significance of Fermi energy – density of energy states – calculation of density of electrons and Fermi energy at 0K – average energy of electrons at 0K – Problem solving.

UNIT II SEMICONDUCTOR PHYSICS **9 Hours**

Intrinsic semiconductors: the law of mass action – expression for density of electrons and holes – determine of carrier concentration – band gab energy. Extrinsic semiconductors: carrier concentration in p-type and n-type semiconductors. Hall Effect: theory – experimental determination of Hall voltage – applications – Problem solving.

UNIT III JUNCTION DIODE CHARACTERISTICS **9 Hours**

Introduction – pn junction diode – volt-ampere characteristics – diode current equation – static and dynamic resistances – space charge – diffusion capacitance – junction diode switching times. Diode circuit with DC voltage source. Applications: full wave rectifier – capacitor filters – clamper circuits.

UNIT IV DIELECTRICS **9 Hours**

Introduction: fundamental definitions in dielectrics – expressions for electronic and ionic polarizations – orientation polarization (qualitative) – space charge polarization – Langevin Debye equation – frequency and temperature effects on polarization – expression for internal field (cubic structure) – Clausius – Mosotti equation – dielectric loss-applications of dielectrics – problem solving.

UNIT V MAGNETIC MATERIALS **9 Hours**

Magnetic materials: basic definitions – properties of Dia, Para and Ferro magnetic materials – explanation of hysteresis curve based on domain theory – hard and soft magnetic materials, Ferrites , Spinels – applications. Magnetic storage device: principle – working – giant magneto resistance.

TOTAL: 45 HOURS

FURTHER READING:

1. Motion of an electron in uniform and non-uniform magnetic fields-electric and magnetic fields in a crossed configuration.

COURSE OUTCOMES:

On the Successful completion of the course, Students will be able to

CO1: Identify different types of emission of electrons and significance of Fermi function
CO2: Explore the carrier concentration and its variation with temperature of different semiconducting materials
CO3: Analyze the I-V characteristics of a junction diode
CO4: Investigate the various polarization mechanisms in dielectrics
CO5: Select appropriate optical and magnetic materials for data storage devices

REFERENCES:

1. Jacob Millman, Christos C Halkias and Satyabrata Jit, “Electronic Devices and Circuits”, McGraw Hill Education (India) Private Limited, New Delhi, 2014.
2. Willam D.Callister, “Materials Science and Engineering an Introduction”, John Wiley and Sons, Inc., 2010.
3. Halliday and Resnick, “Fundamentals of Physics”, John Wiley and Sons, Inc., 2011.
4. R.S.Sedha, “A textbook of Applied Electronics”, S.Chand & Company Ltd., New Delhi, 2010.
5. S.O.Pillai, “Solid State Physics”, New Age International Publications, New Delhi, 2010.
6. M.N.Avadhanu and P.G.Kshirsagar, “A Text Book of Engineering Physics”, S.Chand & Company Ltd., New Delhi, 2011.

1701CH201 **ENVIRONMENTAL STUDIES** **L T P C**
(Common to all B.E. / B.Tech Degree Programmes) **3 0 0 3**

COURSE OBJECTIVES:

1. Realize the interdisciplinary and holistic nature of the environment.
2. Understand how natural resources and environment affect the quality of life and stimulate the quest for sustainable development.
3. Recognize the socio-economic, political and ethical issues in environmental science.

UNIT I ECOSYSTEMS AND BIODIVERSITY **10 Hours**

Concept of an ecosystem - structure and function of an ecosystem - producers, consumers and decomposers - Oxygen cycle and Nitrogen cycle - energy flow in the ecosystem - ecological succession processes - Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) - Introduction to biodiversity definition: genetic, species and ecosystem diversity - value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values - hot - spots of biodiversity - threats to biodiversity: habitat loss, poaching of wildlife, man - wildlife conflicts - endangered and endemic species of India - conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Documentation of the medicinal plants in your native place.

UNIT II NATURAL RESOURCES **10 Hours**

Forest resources: Use and over - exploitation, deforestation, case studies - timber extraction, mining, dams and their effects on forests and tribal people - Water resources: Use and overutilization of surface and ground water, dams-benefits and problems - Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer - pesticide problems, water logging, salinity, case studies - Energy resources: Growing energy needs, renewable and nonrenewable energy sources, use of alternate energy sources. Energy Conversion processes - Biogas - production and uses, anaerobic digestion; case studies - Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification - role of an individual in conservation of natural resources - Equitable use of resources for sustainable lifestyles. Documentation of the effect of modern Agriculture in your nearby Village.

UNIT III ENVIRONMENTAL POLLUTION **9 Hours**

Definition - Source, causes, effects and control measures of: (a) Air pollution - Mitigation procedures - Control of particulate and gaseous emission, Control of SO_x, NO_x, CO and HC) - Technology for capturing CO_2 (metallo- organic frame works) (b) Water pollution - Waste water treatment processes. (c) Soil pollution - soil waste management: causes, effects and control measures of municipal solid wastes - (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards - role of an individual in prevention of pollution - pollution case studies. Documentation study of local polluted site - Urban / Rural / Industrial / Agricultural.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT **8 Hours**

From unsustainable to sustainable development - urban problems related to energy - water conservation, rain water harvesting, watershed management - environmental ethics: Issues and possible solutions - 12 Principles of green chemistry - consumerism and waste products - environment protection act - Air act - Water act - Wildlife protection act - Forest conservation act - The Biomedical Waste (Management and Handling) Rules; 1998 and amendments - scheme of labeling of environmentally friendly products (Ecomark) central and state pollution control boards - disaster management: floods, earthquake - Public awareness. Analyze the recent steps taken by government of India to prevent pollution (Green India and Clean India).

UNIT V HUMAN POPULATION AND THE ENVIRONMENT **8 Hours**

Population growth, variation among nations - population explosion - family welfare programme - environment and human health - human rights - value education - HIV / AIDS - women and child welfare - Environmental impact analysis (EIA) - GIS - remote sensing - role of information technology in environment and human health - Case studies. Documentation study of the Human health and the environment in nearby Hospital (Statistical report).

TOTAL: 45 HOURS

FURTHER READING:

Human rights: E - waste and biomedical waste - Identification of adulterants in food materials

COURSE OUTCOMES:

On the Successful completion of the course, Students will be able to

CO1: Describe the importance of ecosystem and its conservation.
CO2: Differentiate various natural resources and the urgent need to conserve the natural resources.
CO3: Explain the different types of pollution and its effects.
CO4: Describe the various environmental protection acts.
CO5: Explain the major diseases, women, child development and the impacts of population explosion.

REFERENCES:

1. Trivedi. R.K., "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol. I and II, Enviro Media, 3rd edition, BPB publications, 2010.
2. Cunningham, W.P.Cooper, T.H. Gorhani, "Environmental Encyclopedia", Jaico Publishing House, Mumbai, 2001.
3. Dharmendra S. Sengar, "Environmental law", Prentice hall of India PVT LTD, New Delhi, 2007.
4. Rajagopalan. R, "Environmental Studies-From Crisis to Cure", Oxford University Press, 2005.
5. Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, New Delhi, 2006.
6. https://en.wikipedia.org/wiki/Carbon_capture_and_storage
7. Ravikrishnan. A., "Environmental Science and Engineering", Sri Krishna Hi-tech Publishing Company Pvt. Ltd.

1701GEX02 **ENGINEERING GRAPHICS** **L T P C**
(Common to all B.E. / B.Tech Degree Programmes) **2 2 0 3**

COURSE OBJECTIVES:

1. To develop in students, graphic skills for communication of concepts, ideas and design of Engineering products.
2. To expose them to existing national standards related to technical drawings.

CONCEPTS AND CONVENTIONS (Not for Examination) **2 Hours**

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT I PLANE CURVES AND FREE HAND SKETCHING **10 Hours**

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves, Scales: Construction of Diagonal and Vernier scales.

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of Objects

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES 10 Hours

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS **10 Hours**

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method and auxiliary plane method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 10 Hours

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS **10 Hours**

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

COMPUTER AIDED DRAFTING (Demonstration Only) **8 Hours**

Basics commands of AutoCAD- two dimensional drawing, editing, layering and dimensioning - coordinate Systems-Drawing practice - orthographic views of simple solids using AutoCAD.

FURTHER READING:

Applications of engineering graphics in students‟ discipline

TOTAL: 60 HOURS

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1: Perform free hand sketching of basic geometrical constructions and multiple views of objects.
CO2: Do orthographic projection of lines and plane surfaces.
CO3: Draw projections and solids and development of surfaces.
CO4: Prepare isometric and perspective sections of simple solids.
CO5: Demonstrate computer aided drafting.

REFERENCES:

1. Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Stores, Bangalore,2007.
2. Luzzader, Warren.J. and Duff,John M., “Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
3. Shah M.B., and Rana B.C., “Engineering Drawing”, Pearson, 2nd Edition, 2009.
4. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2008.
5. Natrajan K.V., “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2009.
6. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
7. Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 50th Edition, 2010.

PUBLICATION OF BUREAU OF INDIAN STANDARDS:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

SPECIAL POINTS APPLICABLE TO UNIVERSITY EXAMINATIONS ON ENGINEERING GRAPHICS:

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.

1701GEX03	PROGRAMMING IN C	L	T	P	C
	(Common to all B.E. / B.Tech Degree Programmes)	3	0	0	3

COURSE OBJECTIVES:

1. To prepare students to comprehend the fundamental concepts
2. To demonstrate fine grained operations in number system
3. To gain exposure in programming language using C
4. To develop programming skills using the fundamentals and basics of C Language

UNIT I BASIC CONCEPTS **8 Hours**

Organization and Classifications of Computer- Generations of Computers- Number System- Problem Solving Techniques – Algorithm Design– Flowchart–Pseudocode

UNIT II INTRODUCTION TO C LANGUAGE **10 Hours**

Overview of C - Constants, Variables and Data Types- Compilation and Linking - Operators and Expressions- Decision Making and Branching – Looping statements

UNIT III ARRAYS AND STRINGS **9 Hours**

Arrays-One Dimensional Array- Declaration and Initialization-Two Dimensional Array-Declaration and Initialization- Programs using Arrays- Strings- String Handling Functions, Programs using Strings- Managing I/O Operations

UNIT IV FUNCTIONS & STRUCTURES **10 Hours**

Functions-Function Prototypes-Declaring, Defining and Calling Functions-Call by value and Call by Reference-Recursive Functions-Structures- Declaration and Definition -Accessing Structure Members-Arrays of Structures-Unions- Programs using Structures and Unions

UNIT V POINTERS & FILES **8 Hours**

Pointers-Dynamic Memory Allocation-Arithmetic Operations using Pointers, Files – File Manipulation-I/O Operations, Preprocessor Directives, Storage Classes

TOTAL: 45 HOURS

FURTHER READING:

Object Oriented Programming Approach.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1: Describe basic concepts of computers
CO2: Paraphrase the operations of number system
CO3: Describe about basic concepts of C-Language
CO4: Understand the code reusability with the help of user defined functions
CO5: Analyze the structure concept, union, file management and preprocessor in C language

REFERENCES:

1. E. Balagurusamy,"Programming in ANSI C", McGraw Hill Education India Private Limited; Seventh Edition, 2017.
2. Pradip Dey, Manas Ghosh , "Computer Fundamentals and Programming in C", Second Edition, Oxford University Press, 2013.
3. Ashok N. Kamthane, "Programming in C", Pearson Education India, 3rd Edition, 2015.
4. Yashavant P. Kanetkar, "Let Us C", BPB Publications, 15th Revised and Updated Edition, 2016.
5. http://nptel.ac.in/

1702EE201 **ELECTRIC CIRCUIT ANALYSIS** **L T P C**

(B.E – Electrical and Electronics Engineering) **3 2 0 4**

COURSE OBJECTIVES:

1. To know about the basics of electric circuits
2. To impart knowledge on solving circuits using network theorems
3. To introduce the phenomenon of resonance and coupled circuits
4. To determine the transient response of circuits
5. To analyze three phase circuits

UNIT I DC CIRCUITS **9 Hours**

Review - Loop and Nodal methods for DC circuits; Theorems - Thevenin‟s, Norton‟s, Superposition, Reciprocity, Maximum power transfer theorem, etc.,

UNIT II AC CIRCUITS **9 Hours**

Review - Loop and Nodal methods for AC circuits; Theorems - Thevenin‟s, Norton‟s, Superposition, Reciprocity, Maximum power transfer theorem, etc.,

UNIT III THREE PHASE CIRCUITS AND NETWORK TOPOLOGY **9 Hours**

Three phase circuits: Three phase balanced/unbalanced voltage sources; analysis of three phase 3-wire and 4-wire circuits with star and delta connected, balanced and unbalanced loads.

Network topology: Graph, directed graph, branch, chord, tree for two port networks; incidence and reduced incidence matrices; applications to network solutions; link current and tie set; tree branch voltage and cut set; duality and dual networks.

UNIT IV TRANSIENT ANALYSIS AND TWO PORT NETWORKS **9 Hours**

Transient response of RL, RC and RLC circuits to DC and AC excitation; Natural and forced oscillations; Laplace transform application to transient solution; Two port networks - Z, Y and H parameters.

UNIT V RESONANCE AND COUPLED CIRCUITS **9 Hours**

Resonant circuits - Series, parallel, series-parallel circuits; effect of variation of Q on resonance; Relations between circuit parameters - Q, resonant frequency and bandwidth.

Coupled circuits - Self and mutual inductance, coefficient of coupling, dot convention; analysis of simple coupled circuits, inductively coupled circuits; single tuned and double tuned circuits.

TOTAL: 45 + 15 HOURS

FURTHER READING:

1. Practical applications of network theorems
2. Applications of coupled circuits and tank circuits

COURSE OUTCOMES:

On the Successful completion of the course, Students will be able to

CO1: Explain the basic laws, theorems and concepts of DC / AC (1 phase and 3 phase) circuits, Resonant and coupled circuits.
CO2: Solve the problems in network topology and to identify the dual of the network.
CO3: Solve the problems in resonance circuits, coupled circuits and two port networks.
CO4: Analyze the transient behavior of first and second order circuits using Laplace transforms.
CO5: Apply Ohms law, Kirchhoff‟s laws, mesh & nodal methods and network theorems to solve circuit problems.
CO6: Analyze three phase 3 wire/ 4wire balanced/ unbalanced star/delta connected loads.

REFERENCES:

1. A. Sudhakar and S.P. Shyammohan, “Circuits and Networks: Analysis and Synthesis”, TMH, 4th Edition, 2010.
2. M.Nahvi and Joseph A.Edminister, “Electric Circuits”, Schaum‟s Outline series, Tata McGraw Hill, New Delhi, 6th Edition, 2014.
3. James W. Nilsson and Susan Riedel, “Electric Circuits”, Pearson, 10th Global Edition, 2014.
4. William H. Hayt, Jack Kemmerly, and Steven M. Durbin, “Engineering circuit analysis”, Tata McGrawHill, 8th Edition, 2013.
5. Charles. K .Alexander and Mathew N.O.Sadiku, “Fundamental of Electric Circuits”, TMH, 5th Edition, New Delhi, 2013.
6. S.N.Sivanandam, “Electric Circuit Analysis”, Vikas Publishing House Pvt. Ltd., New Delhi, 2nd Edition, 2008.
7. T.S.KV. IYER, “Theory and Problems in Circuit Analysis”, Tata McGraw Hill, 2nd Edition, 2010.
8. A. Chakrabarti, “Circuits Theory: Analysis and Synthesis”, Dhanpat Rai & Co., New Delhi, 2014.

1701GEX51	PROGRAMMING IN C LABORATORY	L	T	P	C
	(Common to all B.E. / B.Tech. Degree Programmes)	0	0	2	1

COURSE OBJECTIVES:

1. To prepare students to comprehend the fundamental concepts.
2. To demonstrate fine grained operations in number system.
3. To gain exposure in programming language using C.
4. To develop programming skills using the fundamentals and basics of C Language.

LIST OF EXPERIMENTS:

1. Working with word and style sheets.
2. Write a C program to implement basic concepts.
3. Write a C program to implement Decision Making and Branching statements.
4. Write a C program to implement looping statements.
5. Write a C program to implement Arrays.
6. Write a C program to implement Strings.
7. Write a C program to implement pointers.
8. Write a C program to implement Structures.
9. Write a C program to work with files in C. **TOTAL: 30 HOURS ADDITIONAL EXPERIMENTS:**
    1. Write a c program to remove the occurrence of "the" word from entered string.
    2. Create two files test1.txt and test2.txt and write a C program to read the file text1.txt character by character on the screen and paste it at the end of test2.txt

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1: Understand basic concepts of computers.
CO2: Implement basic concepts of c-language.
CO3: Implement arrays, strings and pointers.
CO4: Implement the basics of structures, unions, file management and preprocessor in C language.

REFERENCES:

1. E. Balagurusamy,"Programming in ANSI C", McGraw Hill Education India Private Limited; Seventh Edition, 2017.
2. Pradip Dey, Manas Ghosh , "Computer Fundamentals and Programming in C", Second Edition, Oxford University Press, 2013.
3. Ashok N. Kamthane, "Programming in C", Pearson Education India, 3rd Edition, 2015.
4. Yashavant P. Kanetkar, "Let Us C", BPB Publications, 15th Revised and Updated Edition, 2016.
5. http://nptel.ac.in/

1701HS251	PHYSICS AND CHEMISTRY LABORATORY-II (Common to all B.E. / B.Tech Degree Programmes)	L 0	T 0	P 2	C 1

COURSE OBJECTIVES:

1. The Objective of this course is to make the students gain practical knowledge to co-relate with the theoretical studies.
2. To achieve perfectness in experimental skills.
3. To bring confidence and ability to develop and fabricate engineering and technical equipments.
4. To make the student acquire practical skills in the wet chemical and instrumental methods for quantitative estimation of hardness, alkalinity, metal ion content, corrosion in metals and cement analysis.

PHYSICS

LIST OF EXPERIMENTS:

1. Using lees disc apparatus, determine the coefficient of thermal conductivity of a bad conductor.
2. Find the band gap value of the given semiconductor diode. Based on the band gap value, identify the given semiconductor.
3. With the aid of spectrometer, find the angle of Prism and refractive index of the medium.
4. Determine the wavelengths of polychromatic source in the visible region using spectrometer grating.
5. Find the depression at the midpoint of the given wooden beam subjected to non-uniform bending and determines the Young‟s modulus of the material of the beam.
6. Find the given unknown resistance using Carey-Foster‟s Bridge.

CHEMISTRY

LIST OF EXPERIMENTS:

1. Conductometric Precipitation titration of $BaCl_2$ Vs Na_2SO_4
2. Estimation of dissolved oxygen in a water sample/sewage by Winklers method.
3. Estimation of chloride content in water by argentometric method.
4. Conductometric titration of mixture of acids.
5. Comparison of alkalinities of the given water samples.

ADDITIONAL EXPERIMENTS:

1. Estimation of heavy metals in the given solution by EDTA method.
2. Determination of concentration of unknown colored solution using spectrophotometer.

TOTAL: 30 HOURS

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1 : Realize the concept of properties of matter and apply the same for practical applications.
CO2 : Identify the suitable laser source for fiber optic communication applications.
CO3 : Determine the velocity of ultrasonic waves and apply the same for day today applications.
CO4 : Classify the different types of crystal structures and analyze their properties.
CO5 : Comprehend the efficacy of quantum equations in modern areas.
CO6 : Illustrate the EMF of the Redox reaction.
CO7 : Compare the Alkalinity of given water Sample with their standards.
CO8 : Identify the Concentration of metal ion present in water sample.
CO9 : Outline the precipitation titration using Conductivity meter.
CO10: Interpret the dissolved oxygen present in the water.

REFERENCES:

1. D.S.Mathur, Elements of Properties of matter, 5th edition, S.Chand & Company Ltd., New Delhi,2012.
2. Charles Kittel, Introduction to Solid State Physics, 8th edition, Wiley India Pvt. Ltd., New Delhi, 2012.
3. Arthur Beiser, Shobhit Mahajan and S. Rai Choudhury, Concepts of Modern Physics, 6th edition, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2010.
4. B.K. Pandey and S. Chaturvedi, Engineering Physics, 1st edition, Cengage Learning India Pvt. Ltd., New Delhi, 2012.
5. Halliday and Resnick, Fundamentals of Physics, John Wiley and Sons, Inc, 2011.
6. Ian Morison, Introduction to Astronomy and Cosmology, John Wiley and Sons, Ltd, 2013.
7. Laboratory Manual on Engineering Chemistry, S.K. Bhasin, S. Rani, Dhanpat Rai Publishing Company, New Delhi, 2011.

1701MA301 ENGINEERING MATHEMATICS III **L T P C**
(Common to B.E - Civil, CSE, EEE, Mech B.Tech- IT Degree Programmes) **3 2 0 4**

PREREQUISITE :

1. Engineering Mathematics I
2. Engineering Mathematics II

COURSE OBJECTIVES:

1. To introduce Fourier series analysis and applications in Engineering, apart from its use in Solving boundary value problems.
2. To acquaint the student with Fourier transform techniques used in wide variety of situations.
3. To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time Systems.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1 Use Fourier series analysis which is central to many applications in engineering(K3)
CO2 Apply Fourier transform techniques used in wide variety of situations(K3)
CO3 Compute the solution of partial differential equations(K3)
CO4 Solve boundary value problem using partial differential equation(K3)
CO5 Apply Z transform techniques for discrete time systems(K3)

UNIT I FOURIER SERIES **12 Hours**

Dirichlet‘s conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Perceval’s identity – Harmonic analysis – Simple Applications

UNIT II FOURIER TRANSFORMS **12 Hours**

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval’s identity

UNIT III PARTIAL DIFFERENTIAL EQUATIONS **12 Hours**

Formation of partial differential equations – Singular integrals — Solutions of standard types of first order partial differential equations – Lagrange‘s linear equation — Linear partial differential equations of second order with constant coefficients of homogeneous type- Applications

UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS **12 Hours**

Classification of PDE – Solutions of one dimensional wave equation – One dimensional equation of heat Conduction – Steady state solution of two-dimensional equation of heat conduction.

UNIT V Z – TRANSFORMS AND DIFFERENCE EQUATIONS **12 Hours**

Z - Transforms – Elementary properties – Inverse Z – transform (using partial fraction and residues) – Convolution theorem – Formation of difference equations – Solution of difference equations using Z – transform.

TOTAL: 60 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

1. Linear Algebra
2. Numerical Solution of non-homogeneous partial differentialequations

REFERENCES:

1. Veerarajan. T., ‐Transforms and Partial Differential Equations‖, Second reprint, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2012
2. Grewal. B.S., ‐HigherEngineering Mathematics‖, 42ndEdition, KhannaPublishers,Delhi, 2012.
3. Bali.N.P and Manish Goyal, ―A Textbook of Engineering Mathematics‖, 7th Edition, Laxmi Publications Pvt. Ltd , 2007
4. Ramana.B.V., ‐Higher Engineering Mathematics‖, Tata McGrawHill Publishing Company Limited, New Delhi, 2008.
5. Narayanan.S., Manicavachagom Pillay.T.K and Ramanaiah.G ‐Advanced Mathematics for Engineering Students‖ Vol. II & III, S.Viswanathan Publishers Pvt. Ltd. 1998.
6.www.nptelvideos.in/2012/11/mathematics-iii.html

1702EE301 ELECTRON DEVICES AND CIRCUITS

L	T	P	C
3	0	0	3

PREREQUISITE:

1. Semiconductor Physics and Devices
2. Electric Circuit Analysis

COURSE OBJECTIVES:

1. To understand the structure and operation of electronic devices
2. To explain the operation and characteristics of electronic circuits
3. To analyze the BJT and FET based amplifier circuits

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1: Explain the structure, operation and V-I Characteristics of Diodes(K2).

CO2: Describe the V-I characteristics of BJT in CB,CE & CC configurations also able to design and analyze amplifier circuits containing BJT as a device (K2).

CO3: Discuss the structure, operation and V-I characteristics of FET also able to design and analyze amplifier circuits containing FET as a device. (K2).

CO4: Explain the need and operation of differential amplifiers, single tuned amplifiers and power amplifiers able to analyze differential and single tuned amplifiers. (K2)

CO5: Analyze negative feedback amplifiers to determine necessary expressions & RC, LC and Crystal Oscillators to find out frequency of oscillations(K2)

UNIT I DIODES **9 Hours**

PN Junction Diode – structure, operation and V-I characteristics; capacitance effect – diffusion capacitance and transition capacitance; diode model; operation of clippers & clampers.

Zener Diode – V-I Characteristics, breakdown mechanism; application – voltage regulator.

Special Function Devices – Structure and operation of LED, Laser diode, Tunnel diode, Schottky diode and Photodiode.

UNIT II BIPOLAR JUNCTION TRANSISTOR CIRCUITS **9 Hours**

BJT – Structure, operation, V-I characteristics of common base, common emitter and common collector configurations; DC and AC load line analysis; determination of Q point; biasing circuits; small signal model – analysis of CB, CE and CC amplifiers; low and high frequency response of an amplifier; Darlington Amplifier and thermal run away/ secondary breakdown.

UNIT III FIELD EFFECT TRANSISTOR CIRCUITS **9 Hours**

JFET – Structure, operation – n channel and p channel, V-I characteristics and biasing circuits of JFET. **MOSFET** – Structure and operation of D-MOSFET & E-MOSFET, V-I characteristics, biasing circuits, small signal mode – analysis of common source and common drain amplifier, high frequency equivalent circuit;
Comparison of devices.

UNIT IV DIFFERENTIAL AND POWER AMPLIFIERS **9 Hours**

Differential Amplifier – Common mode and difference mode analysis of BJT based differential amplifier. **Single Tuned Amplifiers** – Gain and frequency response of single tuned BJT and FET amplifier; neutralization methods.

Power Amplifiers – Class A, class B, class C and class AB Amplifiers (Qualitative analysis).

UNIT V FEEDBACK AMPLIFIERS AND OSCILLATORS **9 Hours**

Negative Feedback – Voltage series, current series, current shunt and voltage shunt amplifiers – Input impedance, output impedance, current gain, voltage gain, overall current gain and overall voltage gain.

Positive Feedback – Barkhausen criterion; RC oscillators – RC phase shift and Wien bridge oscillators; LC oscillators – Hartley, Colpitts and Clapp; Crystal oscillators – Miller and Pierce crystal oscillators.

FURTHER READING / CONTENT BEYOND SYLABUS / SEMINAR : **TOTAL: 45 HOURS**

1. Multistage Amplifiers
2. Design of Multi vibrators using BJT

REFERENCES:

1. Milman, Halkias and satyabrata Jit, ―Electronic Devices and Circuits‖ 4th Edition, McGraw Hill Pvt. Ltd., 2015.
2. Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory‖, 11th Edition, PHI Ltd., 2015.
3. David A. Bell, ―Electronic Devices and Circuits‖, 5th Edition, Oxford University Press, 2008.
4. Thomas L. Floyd, ―Electronic Devices‖, 10th Edition, An Imprint of Mc Millan publishing company, 2017.
5. Prof. A. N. Chandorkar., IIT Bombay online lecture series on Analog Electronics ttp://nptel.ac.in/courses/117101106/
6.Prof.S.Karmalkar,IIT Madras, online lecture series on Solid State Devices http://nptel.ac.in/courses/117106091/
7.https://onlinecourses.nptel.ac.in/noc18_ee32/preview

1702EE302 DIGITAL ELECTRONICS

L	T	P	C
3	0	0	3

PREREQUISITE :

1. Applied Physics for Engineers
2. Electric Circuit Analysis

COURSE OBJECTIVES:

1. To study the fundamentals of digital systems, programmable logic devices and logic families.
2. To design and analyze digital systems.
3. To apply the digital simulation techniques for application oriented digital circuits.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1 Solve digital system problems using number systems, binary codes, logic gates and Boolean algebra(K3)

CO2 Apply Boolean laws and Karnaugh map to reduce the switching functions(K3)

CO3 Construct combinational logic circuits using logic gates and multiplexers(K3)

CO4 Build synchronous sequential logic circuits using excitation table, stable table and state diagrams(K3)

CO5 Construct asynchronous sequential logic circuits using flow table, transition table, state assignment and state reduction techniques (K3)

CO6 Implement Boolean functions and combinational logic circuits using memories, programmable logic devices and logic families (K3).

UNIT I NUMBER SYSTEM AND BOOLEAN ALGEBRA 9 Hours

Review of number system, Types and conversion codes , BCD, Gray code, Excess 3 code; Error detection and correction codes – Parity ,Hamming codes; Boolean algebra – De Morgan's theorem ,switching functions and Simplification using K-maps.

UNIT II COMBINATIONAL CIRCUITS 9 Hours

Design using logic gates – Design of adders, subtractors, comparators; code converters – encoders, decoders; Multiplexers and de-multiplexers– Function realization using multiplexers; Booth multiplier and Array Multiplier.

UNIT III SYNCHRONOUS SEQUENTIAL CIRCUITS 9 Hours

Flip flops – SR, JK, Master Slave JK and D flip flop, T flip flop; Analysis of synchronous sequential circuits – Design of synchronous sequential circuits, Counters; state diagram – state reduction – state assignment.

Unit IV ASYNCHRONOUS SEQUENTIAL CIRCUITS 9 Hours

Analysis of asynchronous sequential machines – State assignment, Asynchronous design problem.

UNIT V MEMORY DEVICES, PROGRAMMABLE LOGIC DEVICES AND LOGIC FAMILIES 9 Hours

Memories – ROM, PROM, EPROM ; Programmable Logic Devices – PLA, PAL, PLD ; Logic families: TTL, ECL, CMOS; Case study on four-bit accumulator.

TOTAL: 45 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR:

1. Introduction to VHDL programming
2. Hazards in Asynchronous sequential circuits

REFERENCES:

1. M. Morris Mano, ―Digital Logic and Computer Design‖, Prentice Hall of India, 4th edition, 2013.
2. A.Anand kumar, ―Fundamentals of digital circuits‖, 3rd Edition, PHI Learnings Pvt. Ltd, 2014.
3. Malvino and Leach, Digital Principles and Applications, Tata McGraw Hill, New Delhi, 7th edition, 2011.
4. Floyd, Digital Fundamentals, Pearson Education, 10th edition, 2011.
5. John F.Wakerly, Digital Design Principles and Practice, Pearson Education, 4th edition, 2008.
6.http://nptel.ac.in/courses/117106086/

1702EE303 ELECTROMAGNETIC THEORY

L	T	P	C
3	2	0	4

PREREQUISITE :

1. Vector Calculus.
2. Electric Circuit Analysis.

COURSE OBJECTIVES:

1. Understand the concepts of vectorcalculus
2. Understand the principles of electric and magneticfields
3. Comprehend the concepts of electromagneticwaves

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1 Explain the basics of electromagnetism, gauss law, coulomb's law, ampere law and thermos of divergence, stokes and pointing.(K2)

CO2 Make use of vector, gradient, divergence, curl in electrostatics and magneto statics. (K3)

CO3 Correlate gauss law, coulomb is law for calculating the charges, forces, field intensity and flux density for a finite, infinite, circular line and boundary condition in an electric field.(K3)

CO4 Correlate gauss law, coulomb's law for calculating the charges, forces, field intensity and flux density or a finite, infinite, circular line and boundary condition in a magnetic field.(K3)

CO5 Determine the Maxwell's equation, wave equation for a time varying field. (K2)

UNIT I INTRODUCTION TO VECTOR CALCULUS 12 Hours

Introduction- scalar and vector fields; different coordinate systems-Cartesian, cylindrical ,spherical coordinate system; divergence theorem; Stroke's theorem; Coulomb's law, Gauss law and its applications.

UNIT II STATIC ELECTRIC FIELDS 12 Hours

Electric field intensity-field due to different types of charges, electric flux density; electric potential due to uniformly charged infinite line, electric potential due to charged circular disc; potential gradient, dipole, field due to dipole; energy density in electrostatic field; electric boundary conditions (between two perfect dielectric and between free space and conductor), capacitance-concept of capacitance, capacitance of two dielectric media and three dielectricmedia.

UNIT III MAGNETOSTATICS 12 Hours

Biot-savart law- applications (infinite and finite long straight conductor, circular loop); Ampere circuital law-applications (infinite long straight conductor, coaxial cable); curl of magnetic field intensity; magnetic flux and magnetic flux density; scalar and vector magnetic potentials; magnetic boundary conditions (between two Perfect dielectric and between free space and conductor).

UNIT IV FORCE, TORQUE AND INDUCTANCE 12 Hours

Lorentz force equation; force between differential current elements; force and torque on a closed circuit; the nature of magnetic materials; magnetization and permeability; self-inductance and mutual inductance-solenoid, Toroid.

UNIT V MAXWELLS EQUATIONS AND TIME VARYING FIELDS 12 Hours

Maxwell's equations for steady fields in point form and integral form; Faraday's law; displacement current; Maxwell's equations in point form and integral form for time-varying field's; comparison of field theory and circuit theory; Poynting theorem, Poynting vector.

TOTAL: 60 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

1. A Seminar on wave propagations in free space, in a conducting medium, dielectric mediums
2. A report on EMI study in home appliances

REFERENCES:

1. William H.Hayt, _Engineering Electromagnetics', Tata McGraw Hill, 2005.
2. Mathew N. O. SADIKU, Elements of Electromagnetics', Oxford University press Inc., seventh edition, 2018.
3. Joseph. A.Edminister, _Theory and Problems of Electromagnetics', Second edition, Schaum Series, Tata McGraw Hill, 1995.
4. AshutoshPramanik, _Electromagnetism – Theory and Applications', Prentice-Hall of India Private Limited, New Delhi, 2006.
5. Kraus and Fleish, _Electromagnetic with Applications', McGraw Hill International Editions, Fifth Edition, 1999.
6. https://onlinecourses.nptel.ac.in/noc18_ee04/preview

1702EE304 POWER PLANT ENGINEERING

L	T	P	C
3	0	0	3

PREREQUISITE :

1. Basic Mechanical Engineering
2. Applied Chemistry

COURSE OBJECTIVES:

1. To have a detailed knowledge about energy sources available and their management.
2. To understand layout of various power plants and the function of various components of the Power plant.
3. To become familiar with operation of various power plants.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1 Understand the construction and operation of Thermal power plants.(K2)
CO2 Select the suitable turbine for hydro power plants. (K2)
CO3 Identify the required turbine, site for diesel and gas power plant. (K2)
CO4 Explain the reactor operation and selection of site in Nuclear power plant. (K2)
CO5 Describe the power generation from various renewable resources. (K2)

UNIT I COAL BASED THERMAL POWER PLANTS 9 Hours

Layout of modern coal power plant; types of boiler; super critical boilers, FBC boilers; Turbines; condensers; steam and heat rate; subsystems of thermal power plants – fuel and ash handling, draught system, feed water Treatment; Energy Scenario – National, international context.

UNIT II HYDRO POWER PLANTS 9 Hours

Introduction to hydro power plant – layout of dams; types, selection of water turbine, advantages and Disadvantages; selection of site for hydro power plant; pumped storage hydro power plant.

UNIT III DIESEL AND GAS POWER PLANTS 9 Hours

Types, open and closed cycle gas turbine, work output & thermal efficiency; inter cooling – regeneration - Advantages and disadvantages; Diesel engine power plant - component and layout.

UNIT IV NUCLEAR POWER PLANTS 9 Hours

Basics of nuclear energy - layout and subsystems of nuclear power plants, nuclear fission and fusion; types of reactor, working of nuclear reactors, boiling water reactor (BWR), pressurized water reactor(PWR), Canada deuterium- uranium reactor (CANDU), breeder, gas cooled reactors; safety measures for nuclear power plants.

UNIT V POWER FROM RENEWABLE ENERGY 9 Hours

Typical layout and associated components including turbines; Principle; Construction and working of wind, tidal, solar photo voltaic, solar thermal, geo thermal, biogas.

TOTAL: 45 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

1. MHD/OTEC power plants
2. New and alternate energy sources

REFERENCES:

1. P.K. Nag, –PowerPlantEngineering,Tata McGraw-HillPublishing CompanyLtd., Third Edition, 2014.
2. M.M. El-Wakil, –PowerPlantTechnology‖, Tata McGraw-HillPublishing CompanyLtd., 2010.
3. Black &Veatch,–PowerPlantEngineering‖Springer, 1996.
4. Thomas C. Elliott, Kao Chen and Robert C. Swanekamp, ―Standard Handbook of Power Plant Engineering‖ Third Edition, McGraw-Hill, 2004.
5. Godfrey Boyle, ―Renewable energy‖ Oxford University Press in association with the Open University, 2004.

1702EE305 ELECTRICAL MACHINERY - 1

L	T	P	C
3	0	0	3

PREREQUISITE :

1. Electric Circuit Analysis
2. Basic Electrical Engineering

COURSE OBJECTIVES:

1. Understand the basic concepts behind the rotating and stationary machines.
2. Evaluate the performance characteristics of DC Generator and DC Motor
3. Explain the different types of Transformers, their working principle and performance

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1 Understand the operation characteristics of DC machines(K2)
CO2 Understand the operation characteristics of Transformer(K2)
CO3 Analyze the performance parameters of DC machine and Transformer(K3)
CO4 Elucidate the applications of transformer(K3)
CO5 Apply the different testing methods to assess the performance of Electrical machines(K3)

UNIT I INTRODUCTION TO MACHINERY CONCEPTS 9 Hours

Magnetic circuits; flux; Inductance; Dynamically and Statically induced EMF; Properties of Magnetic materials;Lossesinmagneticmaterials,ACoperationofmagneticmaterials;PrinciplesofElectromechanical Energy conversion - Energy conversion through magnetic field and electric field.

UNIT II DC GENERATOR 9 Hours

Principle, Construction and Working of DC generator; EMF equation; Classification; Armature reaction; Commutation; Compensating winding; Generator characteristics.

UNIT III DC MOTOR 9 Hours

Principle of operation; Back EMF of DC motors; Classification; Torque equation; Speed-torque characteristics; Winding diagram; Motor starters; Braking methods; Introduction to permanent magnet DC motor.

UNIT IV TRANSFORMER 9 Hours

Transformer-Principle, construction, Ideal transformer, Equivalent circuit, Phasor diagram, Parallel operation of Transformers; Three phase transformer connections-Tertiary winding; Voltage regulation; Inrush current; Per unit representation; Autotransformer.

UNIT V TESTING & APPLICATIONS OF ELECTRICAL MACHINES 9 Hours

Efficiency and Losses in Electrical machines; DC motor testing- Swinburne‘s test, Brake test, Hopkinson test- Transformer testing- Sumpner‘s test, Polarity test; Selection of DC Motors; Applications of DC motors; Applications of transformers.

TOTAL: 45 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

1. DC motors in everyday life.
2. Applications of transformer in home and industries.

REFERENCES:

1. D. P. Kothari and I. J. Nagrath, Electric Machines, Tata McGraw Hill Publishing Company Ltd, 2010.
2. Edward Hughes, Electrical and Electronic Technology, 12th edition, Pearson, 2016.
3. P. S. Bimbhra, Electrical Machinery, Khanna Publishers, 7th edition, 2011.
4. B. L. Theraja and A. K. Theraja, ―Text Book of Electrical Technology: AC & DC Machines (Volume- 2)‖, S.Chand & Company Ltd., New Delhi, 2008.
5. M.N.Bandyopadhyay, Electrical Machines Theory and practice, PHI Learning Pvt. Ltd, New Delhi 2007.
6. Electrical Machines-I Nptel lecture video by Dr. D.Kastha, IIT Kharagpur

1702EE351 ELECTRICAL MACHINERY LABORATORY - 1

L	T	P	C
0	0	4	2

PREREQUISITE :

1. Study of Electrical circuits
2. Basics of rotating and static machinery concepts

COURSE OBJECTIVES:

1. Complete the circuit to test a given electrical machine.
2. Analyze the performance characteristics of various electrical machines
3. Evaluate the performance of transformer

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1 Draw the circuits for a given electrical machine (k2).

CO2 Obtain the performance characteristics of DC Generators.(K3)

CO3 Analyze the operating behavior of DC motors under various loading condition. (K3)

CO4 Obtain the equivalent circuit parameters of transformer(K3)

CO5 Know the different starting and control measures involved in the operation of electrical machines. (K2)

LIST OF EXPERIMENTS:

1. Study of DC Motor starters
2. Study of DC motor windings.
3. Study of three phase transformer connections
4. Swinburne‘s test and Load test on DC shunt motor.
5. Load test on DC series motor
6. Load test on DC compound motor
7. Speed control of DC shunt motor (Field control & armature control method)
8. Open circuit and load characteristics of DC shunt generator
9. Open circuit and short circuit test on single phase transformer
10. Open circuit and short circuit test on three phase transformer
11. Load test on single/three phase transformer
12. Separation of core losses on single phase transformer

TOTAL: 60 HOURS

ADDITIONAL EXPERIMENTS / INNOVATIVE EXPERIMENTS :

1. Cut view study of DC motor.
2. Sumpner‘s test on single phase transformer.

REFERENCES:

1. B.A.Naveen Antony, ―Electrical Machinery laboratory-1 Manual‖, 2018.

2. D.P. Kothari & B.S. Umre, Laboratory Manual for Electrical Machines, I.K. International publishing house Pvt. Ltd., 2013.

3. B. L. Theraja and A. K. Theraja, ―Text Book of Electrical Technology: AC & DC Machines – Volume 2‖, S.Chand & Company Ltd., New Delhi, 2008.

1702EE352 ELECTRON DEVICES AND CIRCUITS LABORATORY

L	T	P	C
0	0	2	1

PREREQUISITE:

1. Semiconductor Physics and Devices
2. Electric Circuit Analysis

COURSE OBJECTIVES:

1. To analyze V-I Characteristics of different switches
2. To Design a transistor based amplifier circuits
3. To understand the operations of Digital Storage Oscilloscope.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1 Illustrate the turn on and turn off process of different switches (K3)
CO2 Design a circuit, which is used to convert ac signal to dc signal (K4)
CO3 Determine voltage gain from CE and CB configurations (K3)
CO4 Determine the frequency and gain value of various types of oscillators and amplifiers.(K3)
CO5 Study and understand the operation of digital storage oscilloscope(K2)

LIST OF EXPERIMENTS:

1. Study on data sheets of electronic devices.
2. Study of digital storage oscilloscope.
3. Characteristics of PN junction diode and Zener diode.
4. Design a half wave and full wave rectifier with and without capacitive filter.
5. Design of Clipper and Clamper circuit.
6. Verify the V-I characteristic of photo diode and phototransistor.
7. Characteristics of CE and CB configurations.
8. Design and verify the frequency response of single stage transistor amplifier.
9. Characteristics of JFET /MOSFET.
10. Design and verify the frequency response of RC phase shift oscillator.

TOTAL: 30 HOURS

ADDITIONAL EXPERIMENTS / INNOVATIVE EXPERIMENTS :

1. Design of transistor based differential amplifier
2. Design of monostable multivibrators

REFERENCES:

1. K. Krishnaram, ―Electronic Devices and Circuits – Lab Manual‖2018.
2. Milman, Halkias and SatyabrataJi,–ElectronicDevicesandCircuits‖4th Edition, McGraw Hill Education (India) Private Ltd, 2015.
3. Thomas L. Floyd, Electronic Devices, 10th Edition, an Imprint of McMillan Publishing Company, 2017.

1704GE351 LIFE SKILLS : SOFT SKILLS **L T P C**

(Common to all B.E / B.Tech Degree Programmes) **0 0 2 1**

PREREQUISITE :

1. Technical English
2. Communicative English

COURSE OBJECTIVES:

1. To develop the students basic soft skills and enable them to get a job.
2. To develop the students 'interpersonal skills and to enable them to respond effectively.
3. To develop the students selling skills and to enable them to apply in their interview process.
4. To develop the students 'Corporate Etiquettes and enable them to respond effectively.
5. To develop the students 'learning by practice of giving different situations.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1 Communicate effectively in their business environment.
CO2 Improve their interpersonal skills, which are mandatory in a corporate world.
CO3 Brand themselves to acquire a job.
CO4 Involve in corporate etiquettes.
CO5 Survive in the different situations.

UNIT I INTRODUCTION TO SOFT SKILLS **6 Hours**

Soft Skills an Overview - Basics of Communication – Body Language – Positive attitude –Improving Perception and forming values – Communicating with others.

UNIT II TEAM Vs TRUST **6 Hours**

Interpersonal skills – Understanding others – Art of Listening - Group Dynamics – Networking - Individual and group presentations - Group interactions – Improved work Relationship.

UNIT III SELLING ONESELF **6 Hours**

How to brand oneself – social media – job hunting – Resume writing – Group Discussion – Mock G.D - .Interview skills – Mock Interview

UNIT IV CORPORATE ETIQUETTES **6 Hours**

What is Etiquette – Key Factors – Greetings – Meeting etiquettes – Telephone etiquettes – email etiquettes – Dining etiquettes – Dressing etiquettes – Rest room etiquettes – Life etiquettes.

UNIT V LEARNING BY PRACTICE **6 Hours**

1. My family. Myself. 2. Meeting people. Making Contacts. 3. A city. Getting about town. 4. Our flat. Home life.5. Travelling. Going abroad. 6. Going through Customs. 7. At a hotel. 8. Shopping. 9. Eating out. 10. Making a phone call. 11. A modern office.12 Discussing business.

TOTAL: 30 HOURS

ASSSESSMENT PATTERN

1. Two assignments (2 x 25 marks = 50 marks)
2. Pragmatic assessment (50 marks)

REFERENCES:

1. Dr.K.Alex, _Soft Skills' Third Edition, S.Chand & Publishing Pvt. Limited, 2009
2. Aruna Koneru, _Professional Communication' Second Edition, Tata McGraw-Hill Education, 2008
3. D.K.Sarma, _You & Your Career' First Edition, Wheeler Publishing & Co Ltd, 1999
4. Shiv Khera _You Can Win' Third Edition, Mac Millan Publisher India Pvt. Limited, 2005

1701MA403	NUMERICAL METHODS AND STATISTICS	L	T	P	C
(Common to B.E - Civil, EEE and Mech.)		3	2	0	4

PREREQUISITE:

1. Engineering Mathematics I
2. Engineering Mathematics II
3. Engineering Mathematics III

COURSE OBJECTIVES:

1. To sole the engineering problem, by use of numerical tools 2.To understand the concept of interpolation
3. To analyze the population and samples using statistics techniques

COURSE OUTCOMES:

After completion of the course, Students will be able to

CO1: Find the intermediate values, when huge amounts of experimental data are involved (K3)
CO2: Solve first order differential equation using Numerical methods (K3)
CO3: Perform Integration using Numerical methods (K3)
CO4: Solve algebraic and transcendental Equations numerically (K3)
CO5: Analyses the statistical data (K3)

UNIT I **INTERPOLATION AND APPROXIMATION** **12Hours**

Interpolationwithunequalintervals-Lagrange'sinterpolation–Newton's divided difference interpolation– Interpolation with equal intervals – Newton's forward and backward difference formulae.

UNIT II **NUMERICAL DIFFERENTIATION** **12 Hours**

Approximation of derivatives using interpolation polynomials-Taylor's series method – Euler's method -Modified Euler's method-Fourth order Runge-Kutta method for solving first order equations

Unit III **NUMERICAL INTEGRATION** **12 Hours**

Numerical integration using Trapezoidal, Simpson's 1/3 rule – Romberg's method - Two point and three Point Gaussian quadrature formulae–Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.

UNIT IV **SOLUTION OF ALGEBRAIC AND TRANSCENDENTALEQUATIONS** **12Hours**

Solution of algebraic and transcendental equations - Newton Raphson method- Solution of linear system of equations - Gauss elimination method – Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel

UNIT V **TESTING OF HYPOTHESIS** **12Hours**

Large sample test based on Normal distribution for single mean and difference of means - Tests based on t and F distributions for testing means and variances – Contingency table (Test for Independency) – Goodness of fit

TOTAL: 60 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR:

1. Finding Eigen value using power method
2. Cubic Spline

REFERENCES:

1. Johnson R.A.Gupta C. B, Miller and Freunds Probability and statistics for Engineers, 7th edition ,Pearson Education,2007
2. Grewal B.S and Grewal J.S, Numerical methods in Engineering and Science, 6th edition,Khanna puplishers,2004
3. Walpole R.E. Myers S.L, Ye.K, Probability and statistics for Eng. and scientists, 8th edition Pearson education,2007
4. Gerald C.F Wheatley P.O, Applied Numerical Analysis, 6th edition ,Pearson education Asia2006
5. Nptel.ac.in/courses/111105035,www.nptelvideos.in/2012/11/Mathematics.html
6. www.learnerstv.com/Free-maths-video lectures -ltv348-page1.html
7. www.indiastudychannel.com

1702EE401 MEASUREMENTS AND INSTRUMENTATION

L	T	P	C
3	0	0	3

PREREQUISITE :

1. Semiconductor Physics and Devices
2. Electron Devices and Circuits

COURSE OBJECTIVES:

1. To learn the measuring instrument characteristics and also to calculate different parameters of Instruments.
2. To empower students to understand the working of electrical equipment used in everyday life.
3. To understand the necessary of modern tools in electrical industry.

COURSE OUTCOMES:

After completion of the course, Student will be able to

CO1: Describe the basic functional elements of measuring instruments and the errors in the measurements systems(K2)

CO2: Discuss the operation and applications of measuring instrument under typical environment (K2).

CO3: Identify the unknown values of resistor, inductor and capacitor of given network using suitable bridge circuit (K3) .

CO4: Explain the construction and working principle of various storage and display devices(K2)

CO5: Make use of sensor and transducers in measuring purpose using data acquisition system(K3)

UNIT I INTRODUCTION OF MEASURING INSTRUMENTS **9 Hours**

Classification of measuring instruments; Functional elements of an instrument ; Static and dynamic characteristics ; loading effect of ammeter and voltmeter; Errors in measurement - Gross, Systematic and Random errors; Statistical Evaluation of measurement data; Standards - International, primary, secondary and working standard, calibration – A case study in calibration of measuring instruments.

UNIT II ELECTRICAL AND ELECTRONICS INSTRUMENTS **9 Hours**

Principle and types of analog and digital voltmeters, ammeters, multimeters,; Single phase and three phase wattmeter and energy meter; Determination of B-H curve; Instrument transformers-current and potential Transformer; comparison of CT and PT; Instruments for measurement of frequency – vibrating read type, electrical resonance type, and Weston frequency meter; Megger.

UNIT III COMPARISON METHODS OF MEASUREMENTS **9 Hours**

D.C & A.C potentiometers; D.C bridges –Wheatstone and Kelvin bridges; A.C bridges-Maxwell bridge, Anderson bridge, Hays bridge, and Schering bridge, self-balancing bridges; Interference & screening – Multiple earth and Earth loops; Electrostatic and electromagnetic interference; Grounding techniques.

UNIT IV STORAGE AND DISPLAY DEVICES **9 Hours**

Recorders - X-Y recorders and digital plotters; CRT display- digital CRO; LED and LCD display; Power quality Analyzer.

UNIT V TRANSDUCERS AND DATA ACQUISITION SYSTEMS **9 Hours**

Classification of transducers -Selection of transducers, Resistive, capacitive, inductive transducers, Piezoelectric and Hall effect transducers:Elementsofdataacquisitionsystem;DataLoggers;A/D,D/Aconverters;Smart Sensors.

TOTAL: 45 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR:

1. Measurement of wind energy using anemometers.
2. Measurement of air pressure using barometers.

REFERENCES:

1. A.K. Sawhney, „A Course in Electrical & Electronic Measurements & Instrumentation", Dhanpat Rai & Co,2004.
2. J. B. Gupta, „A Course in Electronic and Electrical Measurements", S. K. Kataria & Sons, Delhi, 2003.
3. H.S. Kalsi, „Electronic Instrumentation", Tata McGraw Hill, II Edition 2004.
4. Martin Reissland, „Electrical Measurements", New Age International (P) Ltd., Delhi, 2001.
5. Alan. S. Morris, Principles of Measurements and Instrumentation, 2nd Edition, Prentice Hall of India, 2003
6. nptel.ac.in/syllabus/108106070/

1702EE402 LINEAR INTEGRATED CIRCUITS

L	T	P	C
3	0	0	3

PREREQUISITE :

1.Electric circuit Analysis
2.Electronic Devices and Circuits

COURSE OBJECTIVES:

1. To understand the fundamentals and fabrication of ICs.
2. To explain the functions, characteristics and applications of op. amp.
3. To describe operation of signal converters, special function ICs and voltage regulators.

COURSE OUTCOMES:

After completion of the course, Student will be able to

CO1 Explain the fundamentals of IC technology and fabrication of diode, capacitance, resistance, FET and typical circuits. (K3)
CO2 Describe the functional block diagram, performance parameters and frequency compensation techniques of operational amplifier (K3).
CO3 Construct analog circuits using operational amplifiers for linear applications. (K3)
CO4 Construct analog circuits with operational amplifiers for non-linear applications. (K3)
CO5 Build signal converters using operational amplifiers. (K3)
CO6 Design timer and voltage regulator circuits using special function ICs(K3)

UNIT I FABRICATION OF INTEGRATED CIRCUITS **9 Hours**

IC classification, fundamental of monolithic IC technology; Epitaxial growth, masking and etching, diffusion of Impurities; realization of monolithic ICs and packaging; fabrication of diodes, capacitance, resistance and FET.

UNIT II OPERATIONAL AMPLIFIER **9 Hours**

Op. amp. introduction - functional block diagram, ideal and practical op-amp characteristics, CMRR, open loop Gain, slew rate, transfer characteristics, input bias and output offset voltage, offset compensation techniques, frequency response characterization, and frequency compensation.

UNIT III APPLICATIONS OF OPERATIONAL AMPLIFIER **9 Hours**

Inverting and non-inverting amplifiers, voltage follower, summing amplifier, differential amplifier, instrumentationamplifier;comparators;integratoranddifferentiator;sinusoidaloscillators-phaseshift,Wein Bridge& Hartley; sample and hold circuit; clipper and clamper; Schmitt trigger.

UNIT IV SIGNAL CONVERTERS **9 Hours**

V/F and F/V converters; V/I and I/V converter; D/A converter - weighted resistor type, R-2R ladder type; A/D Converters- flash type, successive approximation type, single slope type, dual slope type, A/D converter using voltage-to-time conversion.

UNIT V SPECIAL FUNCTION INTEGRATED CIRCUITS **9 Hours**

555 Timer - functional block diagram and description, monostable and astable operation; 566 voltage controlled oscillator; 565 PLL - functional block diagram, principle of operation, characteristics; IC voltage regulators – regulation, need for voltage regulation; LM78XX, 79XX fixed voltage regulators; LM 317 & LM723; Interpretation of IC data sheets.

Total: 45 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR:

1. Interpretation of data sheets of an OPAMP
2. Active filters

REFERENCES:

1. D Roy Choudhury and Sheil B.Jani, “Linear Integrated Circuits” 4th Edition, New Age International, New Delhi, 2014.
2. S Salivahanan and V S Kanchana Bhaaskaran, “Linear Integrated Circuits”, 2nd Edition, McGraw-Hill Education, 2014.
3. Ramakant A.Gayakward, “Op-amps and Linear Integrated Circuits”, 4th Edition, PHI Learnings, 2003.
4. B Somanathan Nair, “Linear Integrated Circuits: Analysis, Design and Applications”, Wiley, 2009.
5. Floyd and Buchla, “Fundamentals of Analog Circuits”, Pearson, 2013.
6. http://nptel.ac.in/courses/117107094/

1702EE403 TRANSMISSION AND DISTRIBUTION

L	T	P	C
3	2	0	4

PREREQUISITE :

1. Power Plant Engineering
2. Electric circuit analysis

COURSE OBJECTIVES:

1. To understand the structure of power system, insulators, cables and substation.
2. To develop expressions for various parameters related to transmission lines.
3. To obtain the equivalent circuits for the transmission lines to determine voltage regulation and efficiency.

COURSE OUTCOMES:

After completion of the course, Student will be able to

CO1: Infer knowledge on the basics of transmission system of power system(K2)
CO2: Develop expressions for the computation of transmission line parameters(K3)
CO3: Obtain the voltage regulation and efficiency from the equivalent circuit of the transmission Lines(K3)
CO4: Compute the voltage distribution in insulator strings (K3)
CO5: Interpret the construction and parameters related to underground cable(K2)
CO6: Develop the transmission line and modern substation layout with grounding techniques(K3)

UNIT I INTRODUCTION TO TRANSMISSION AND DISTRIBUTION SYSTEM 12 Hours

Structure of electric power system- Single line diagram, Typical standard specifications of transmission and distribution system; HVDC transmission - comparison between HVAC and HVDC; Substation and its types, Typical key diagram of a 11kV / 400V substation; feeders, distributors and service mains - radial and ring main systems; calculation of voltage in distributors with concentrated and distributed loads.

UNIT II PARAMETERS OF TRANSMISSION LINE 12 Hours

Parameters of transmission lines; types of conductors; resistance, inductance and capacitance of single phase, three phase, symmetrical and unsymmetrical transposed conductors; self and mutual GMD; skin and proximity Effects; interference with neighboring communication circuits; corona discharges.

UNIT III MODELLING AND PERFORMANCE OF TRANSMISSION LINES 12 Hours

Classification of lines - short line, medium line and long line; equivalent circuits, phasor diagram, attenuation Constant, phase constant, surge impedance; transmission efficiency and voltage regulation; real and reactive power flow in lines, surge impedance loading; methods of voltage control; Ferranti effect.

UNIT IV INSULATORS AND UNDERGROUND CABLES 12 Hours

Insulators - types, potential distribution in insulator string, improvement of string efficiency, testing of insulators; underground cables - constructional features of LT and HT cables, capacitance of single-core cable, Grading of cables, power factor and heating, capacitance of 3- core belted cable; DC cables.

UNIT V MECHANICAL DESIGN OF LINES AND GROUNDING 12 Hours

Mechanical design of transmission line; sag and tension calculations for different weather conditions; tower Spotting- types of towers; substation layout (AIS, GIS); methods of grounding.

TOTAL: 60 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

1. Distribution automation
2. Distributed generation

REFERENCES:

1. C.L.Wadhwa, „Electrical Power Systems", New Academic Science Ltd, seventh edition 2017.
2. J.Brian, Hardy and Colin R. Bayliss, "Transmission and Distribution in Electrical Engineering" Newnes; 'Fourth Edition, 2012.
3. D.P.Kothari, I.J. Nagarath, "Power System Engineering", Tata McGraw-Hill Publishing Company limited, New Delhi, 2nd ed., 2008.
4. Hadi Saadat, „Power System Analysis, " PSA Publishing; Third Edition, 2010.
5. S. L. Uppal "Electrical Power" Khanna Publisher, 13th Edition , 1988
6. http://nptel.ac.in/courses/108108099/, http://nptel.ac.in/courses/108105053/2

1702EE404	ELECTRICAL MACHINERY-II	L	T	P	C
		3	0	0	3

PREREQUISITE :

1. Electrical Machinery-I.
2. Electromagnetic Field.

COURSE OBJECTIVES:

1. To impart the basic operation and construction of various AC machines.
2. To describe the performance of synchronous machine by different methods.
3. To analyze the performance characteristics and equivalent circuits of AC machines.

COURSE OUTCOMES:

After completion of the course, Student will be able to

CO1: Investigate the percentage regulation of three-phase AC generator using various regulation methods(K3)

CO2: Inspect the performance characteristics of three-phase synchronous motor by conducting various test (K3).

CO3: Identify the performance characteristics of three-phase induction motor by conducting OC and SC test (K3).

CO4: Gain Knowledge about the concepts of starters & speed control methods (K2)

CO5: Describe the characteristics behavior of various types of single-phase induction motor and special machines (K2)

UNIT I SYNCHRONOUS GENERATOR 9 Hours

Constructional details; types of rotors ;EMF equation; armature reaction ;parallel operation ;voltage regulation Methods – EMF, MMF, ZPF & ASA methods; two reaction theory; sliptest; capability curves.

UNIT II SYNCHRONOUS MOTOR 9 Hours

Principle of operation; torque equation; V and Inverted V curves ;Power input and power developed equations; Starting methods; hunting; damper windings; synchronous condenser; Synchronous induction motor.

UNIT III THREE PHASE INDUCTION MOTOR 9 Hours

Constructional details, types; principle of operation; rotating magnetic field; slip; equivalent circuit; Torque-Slip characteristics; torque equation; circle diagram; separation of losses; cogging and crawling; induction Generators; - double cage deep bar induction motors.

UNIT IV STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTOR 9 Hours

Need for starting; types of starters – star delta starter, auto transformer starter, DOL starter; speed control – voltage control, frequency control, pole changing, cascaded connection, v/f control, slip power recovery scheme; Braking of three-phase induction motor.

UNIT V SINGLE PHASE INDUCTION MOTOR & FRACTIONAL HORSE POWERMOTOR 9 Hours

Single phase induction motors ; rotating vs alternating magnetic field; double revolving field theory; Torque - speed characteristics; equivalent circuit; starting methods; hysteresis motor; stepper motor; universal motor; linear induction motor, brushless DC motor.

Total: 45 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

1. Role of poly phase induction machines in windmill power generation.
2. New alternator technology in hybrid vehicle.

REFERENCES:

1. Fitzgerald A.E,CharlesKingsley, Stephen. D.Umans, „Electric Machinery", Published byTata McGraw-Hill Education Pvt. Ltd. 2015, 6th Edison.
2. Kothari D.P and I.J. Nagrath, „Electric Machines", Published by Tata McGraw -Hill Education Pvt. Ltd, 2010, 5th Edison.
3. BhimbhraP.S, "Electrical Machinery"„Khanna Publishers, 7th Edition, 2003.
4. Bandyopadhyay M.N, "Electrical Machines Theory and Practice", PHI Learning PVT LTD., New Delhi, 2009
5. Charles's A. Gross, "Electric /Machines", CRC Press, 2nd Edition, 2010.

1702EC406 COMMUNICATION ENGINEERING

L	T	P	C
3	0	0	3

PREREQUISITE :NIL

COURSE OBJECTIVES:

1. To provide an introduction on different analog modulation and demodulation systems.
2. To know the principles of sampling & quantization.
3. To learn the various baseband transmission schemes.
4. To understand the various Band pass signaling schemes.
5. To become skilled at fundamentals of mobile and wireless communication technologies and its applications.

COURSE OUTCOMES:

After completion of the course, Student will be able to

CO1:Explain the fundamental techniques of generations and detections for Amplitude, Frequency and Phase modulations(K2)

CO2:Construct a sampled and quantized signal for baseband transmission. (K3).

CO3:Describe the concepts of Digital modulation schemes for digital data transmission. (K3).

CO4:Apply cellular concepts in mobile communication networks(K3).

CO5:Make use of multiple access mechanisms of mobile communication networks(K3)

UNIT I AMPLITUDE MODULATION SYSTEMS 9 Hours

Need for modulation – Classifications of modulation techniques-Generation and detection: AM, DSBSC, SSB-SC, VSB-Comparison of Amplitude modulation systems- AM transmitters-AM receivers.

UNIT II ANGLE MODULATION SYSTEMS 9 Hours

Frequency modulation: Narrowband and wideband FM- Phase Modulation- Generation of FM signal: Direct FM, indirect FM- Demodulation of FM signals -FM stereo multiplexing- FM transmitters- FM receivers.

UNIT III SAMPLING AND QUANTIZATION 9 Hours

Sampling Process – Aliasing – Instantaneous sampling – Natural Sampling –Flat Sampling – Quantization of signals –sampling and quantizing effects –channel effects – SNR for quantization pulses – data formatting Techniques –Time division multiplexing.

UNIT IV DIGITAL TRANSMISSION 9 Hours

Baseband Transmission: Wave form representation of binary digits - PCM, DPCM, DM, ADM systems, Pass band Transmission: ASK, FSK, PSK, QPSK, DQPSK, MSK, QAM , Noise performance of ASK, FSK, PSK, QPSK, DQPSK, MSK, QAM

UNIT V CELLULAR COMMUNICATION 9 Hours

Introduction, Frequency reuse, Cell Assignment techniques, Hand off Strategies, Interference and System Capacity, Trunking and Grade of Service, Improving Coverage and capacity in cellular systems. Multiple Access techniques: FDMA, TDMA, CDMA, SDMA

Total: 45 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

Digital Communication Techniques
Advanced Wireless Communication

REFERENCES:

1. G.Kennedy and B.Davis, Electronic Communication Systems, fourth Edition, Tata McGraw-Hill -2008.
2. Simon Haykin, Communication Systems, John Wiley, 2001.
3. Simon Haykin, “Digital Communications”, John Wiley, 2006.
4. Amitabha Bhattacharya, “Digital Communication”, Tata McGraw Hill, 2006.
5. Rappaport. T.S., “Wireless Communications: Principles and Practices”, Second Edition, PHI, 2014

1702EE451 ELECTRICAL MACHINERY LABORATORY-II

L	T	P	C
0	0	4	2

PREREQUISITE :

Electrical Machinery Laboratory-I

COURSE OBJECTIVES:

1. To know the performance characteristics of induction motors.
2. To compare various regulation methods of Synchronous machines.
3. To study the characteristics of brushless DC motor.

COURSE OUTCOMES:

After completion of the course, Student will be able to

CO1: Investigate various regulation methods of synchronous machines by conducting OCC and SCC test (K3)

CO2: Experiment on synchronous machines for obtaining performance characteristics by conducting V and inverted V curve test (K3).

CO3: Compute the performance characteristics of single phase and three-phase induction motor by conducting load, no load and blocked rotor test(K3)

CO4: Construct the characteristics of special machines (K3)

CO5: Study about various types of starters in AC motor (K2)

LIST OF EXPERIMENTS:

1. Study of AC motor starters
2. No load & blocked rotor test and Load test on single phase induction motor
3. No load & blocked rotor test and Load test on three phase induction motor
4. Separation of no load losses of three phase induction motor
5. Voltage regulation of an alternator by EMF,MMF method
6. Voltage regulation of an alternator by ZPF method
7. Voltage regulation of an alternator by ASA method
8. V & inverted V curve of three phase synchronous motor
9. Determination of Xd and Xq and regulation of salient pole alternator
10. Characteristic analysis of brushless DC motor

Total: 60 Hours

ADDITIONAL EXPERIMENTS / INNOVATIVE EXPERIMENTS :

1. Measurements of positive & negative sequence current in three phase alternator
2. Synchronization / Parallel operation of three phase alternator

REFERENCES:

1. Kothari. D.P & Umre. B.S “Laboratory manual for electrical machines”, I.K international Publishing House (P) Ltd. 2013 Edition
2. Suresh Babu. P.J, “Electrical Machinery Lab II Manual”, 2018.

1702EE452	ANALOG AND DIGITAL INTEGRATED CIRCUITS	L	T	P	C
LABORATORY		0	0	2	1

PREREQUISITE:

1. Electronic Devices and Circuits Lab
2. Digital Electronics

COURSE OBJECTIVES:

1. To test the characteristics of Amplifiers
2. To design and testing of logic gates
3. To implement and characterizing the circuit behavior with digital and analog ICs

COURSE OUTCOMES:

After completion of the course, Student will be able

CO1: Apply various types of biasing and amplifier configuration (K3).

CO2: Use simplification techniques to design a combinational hardware circuit (K3)

CO3: Design and Implement combinational and sequential circuits (K3)

CO4: Design and Implement a simple digital system (K3)

CO5: Apply analog and digital electronic circuits (K3)

LIST OF EXPERIMENTS:

Frequency response of CE Amplifier
Darlington amplifier Using BJT
Implementation of Boolean functions, adder/ subtractor circuits.
Design and implementation of code converters using logic gates
Parity generator and parity checker
Design and implementation of encoder and decoder using logic gates
Construction and verification of 4 bit ripple counter
Implementation of SISO, SIPO, PISO and PIPO shift registers using Flip-flops
Design and implementation of Multiplexer and De-multiplexer using logic gates
Timer IC application: Study of NE/SE 555 timer in astable and mono stable operation.

TOTAL: 30 HOURS

ADDITIONAL EXPERIMENTS / INNOVATIVE EXPERIMENTS:

1. IC voltage regulators
2. Real time applications using logic gates IC

REFERENCES:

1. Dr. T. Suresh Padmanabhan and K.Nandakumar, “Analog and Digital Integrated Circuits Manual”, 2018.
2. Integrated circuits: solution manual: analog digital circuits and systems manual by Jacob Millman.

1704GE451 LIFE SKILLS: VERBAL ABILITY

L	T	P	C
0	0	2	1

PREREQUISITE:

Technical English – I and II

COURSE OBJECTIVES:

1. To help students comprehend and use vocabulary words in their day-to-day communication.
2. To apply appropriate reading strategies for interpreting technical and non-technical Documents used in job-related settings.
3. To ensure students will be able to use targeted grammatical structures meaningfully and Appropriately in oral and written production.
4. To enable the students to arrange the sentences in meaningful unit and to determine whether constructions rely on active or passive voice.
5. To apply the principles of effective business writing to hone communication skills.

COURSE OUTCOMES:

After completion of the course, Student will be able to

CO1: Use new words in their day-to-day communication.

CO2: Gather information swiftly while reading passages.

CO3: Students are proficient during their oral and written communication.

CO4: Rearrange the sentences and able to identify the voice of the sentence.

CO5: Students use their knowledge of the best practices to craft effective business documents

UNIT I VOCABULARY USAGE **6 Hours**

Introduction - Synonyms and Antonyms based on Technical terms – Single word Substitution – Newspaper, Audio and video listening activity.

UNITII COMPREHENSION ABILITY **6 Hours**

Skimming and Scanning – Social Science passages – Business and Economics passages – latest political and current event based passages – Theme detection – Deriving conclusion from passages.

UNIT III BASIC GRAMMAR AND ERROR DETECTION **6 Hours**

Parallelism – Redundancy – Ambiguity – Concord - Common Errors – Spotting Errors – Sentence Improvement – Error Detection FAQ in Competitive exams.

UNIT IV REARRANGEMENT AND GENERAL USAGE **6 Hours**

Jumble Sentences – Cloze Test - Idioms and Phrases – Active and passive voice – Spelling test.

UNIT V APPLICATION OF VERBAL ABILITY **6 Hours**

Business Writing - Business Vocabulary - Delivering Good / Bad News - Media Communication - Email Etiquette – Report Writing - Proposal writing – Essay writing– Indexing –Market surveying.

Total: 30 Hours

ASSESSMENT PATTERN

1. Two assignments (2 x 25 marks = 50 marks)
2. Pragmatic assessment (50 marks)

REFERENCES:

1. Arun Sharma and Meenakshi Upadhyav, How to Prepare for Verbal Ability and Reading Comprehension for CAT, McGrawHill Publication, Seventh Edition 2017.
2. R S Aggarwal and Vikas Aggarwal , Quick Learning Objective General English, S.Chand Publishing House, 2017.
3. Dr.K. Alex, Soft Skills, S.Chand Publishing House, Third Revise Edition, 2014.
4. Raymond Murphy, Essential English Grammar in Use, Cambridge University press, New Delhi, Third Edition, 2007.

ANNA UNIVERSITY
AFFILIATED INSTITUTIONS

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING
R – 2013

EE6501	**POWER SYSTEM ANALYSIS**	**L T P C**
		3 0 0 3

OBJECTIVES:

- To model the power system under steady state operating condition.
- To apply numerical methods to solve the power flow problem.
- To model and analyze the system under faulted conditions.
- To model and analyze the transient behaviour of power system when it is subjected to
- a fault.

UNIT I INTRODUCTION **9**

Need for system planning and operational studies – basic components of a power system.-Introduction to restructuring - Single line diagram – per phase and per unit analysis – Generator - transformer – transmission line and load representation for different power system studies.- Primitive network - construction of Y-bus using inspection and singular transformation methods – z-bus.

UNIT II POWER FLOW ANALYSIS **9**

Importance of power flow analysis in planning and operation of power systems - statement of power flow problem - classification of buses - development of power flow model in complex variables form - iterative solution using Gauss-Seidel method - Q-limit check for voltage controlled buses – power flow model in polar form - iterative solution using Newton-Raphson method .

UNIT III FAULT ANALYSIS – BALANCED FAULTS **9**

Importance of short circuit analysis - assumptions in fault analysis - analysis using Thevenin's theorem - Z-bus building algorithm - fault analysis using Z-bus – computations of short circuit capacity, post fault voltage and currents.

UNIT IV FAULT ANALYSIS – UNBALANCED FAULTS **9**

Introduction to symmetrical components – sequence impedances – sequence circuits of synchronous machine, transformer and transmission lines - sequence networks analysis of single line to ground, line to line and double line to ground faults using Thevenin's theorem and Z-bus matrix.

UNIT V STABILITY ANALYSIS **9**

Importance of stability analysis in power system planning and operation - classification of power system stability - angle and voltage stability – Single Machine Infinite Bus (SMIB) system: Development of swing equation - equal area criterion - determination of critical clearing angle and time – solution of swing equation by modified Euler method and Runge-Kutta fourth order method.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and analyze power system operation, stability, control and protection.

TEXT BOOKS:

1. Nagrath I.J. and Kothari D.P., 'Modern Power System Analysis', Tata McGraw-Hill, Fourth Edition, 2011.
2. John J. Grainger and W.D. Stevenson Jr., 'Power System Analysis', Tata McGraw-Hill, Sixth

reprint, 2010.
3. P. Venkatesh, B.V. Manikandan, S. Charles Raja, A. Srinivasan, ' Electrical Power Systems-Analysis, Security and Deregulation', PHI Learning Private Limited, New Delhi, 2012.

REFERENCES:

1. Hadi Saadat, 'Power System Analysis', Tata McGraw Hill Education Pvt. Ltd., New Delhi, 21st reprint, 2010.
2. Kundur P., 'Power System Stability and Control, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 10th reprint, 2010.
3. Pai M A, 'Computer Techniques in Power System Analysis', Tata Mc Graw-Hill Publishing Company Ltd., New Delhi, Second Edition, 2007.
4. J. Duncan Glover, Mulukutla S. Sarma, Thomas J. Overbye, ' Power System Analysis & Design', Cengage Learning, Fifth Edition, 2012.
5. Olle. I. Elgerd, 'Electric Energy Systems Theory – An Introduction', Tata McGraw Hill Publishing Company Limited, New Delhi, Second Edition, 2012.
6. C.A.Gross, "Power System Analysis," Wiley India, 2011.

EE6502 MICROPROCESSORS AND MICROCONTROLLERS L T P C
3 0 0 3

OBJECTIVES:

- To study the Architecture of uP8085 & uC 8051
- To study the addressing modes & instruction set of 8085 & 8051.
- To introduce the need & use of Interrupt structure 8085 & 8051.
- To develop skill in simple applications development with programming 8085 & 8051
- To introduce commonly used peripheral / interfacing

UNIT I 8085 PROCESSOR 9

Hardware Architecture, pinouts – Functional Building Blocks of Processor – Memory organization – I/O ports and data transfer concepts– Timing Diagram – Interrupts.

UNIT II PROGRAMMING OF 8085 PROCESSOR 9

Instruction -format and addressing modes – Assembly language format – Data transfer, data manipulation& control instructions – Programming: Loop structure with counting & Indexing – Look up table – Subroutine instructions – stack.

UNIT III 8051 MICRO CONTROLLER 9

Hardware Architecture, pintouts – Functional Building Blocks of Processor – Memory organization – I/O ports and data transfer concepts– Timing Diagram – Interrupts-Comparison to Programming concepts with 8085.

UNIT IV PERIPHERAL INTERFACING 9

Study on need, Architecture, configuration and interfacing, with ICs: 8255 , 8259 , 8254,8237,8251, 8279 ,- A/D and D/A converters &Interfacing with 8085& 8051.

UNIT V MICRO CONTROLLER PROGRAMMING & APPLICATIONS 9

Data Transfer, Manipulation, Control Algorithms& I/O instructions – Simple programming exercises-key board and display interface – Closed loop control of servo motor- stepper motor control – Washing Machine Control.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and analyse, linear and digital electronic circuits.
- To understand and apply computing platform and software for engineering problems.

TEXT BOOKS:

1. Krishna Kant, "Microprocessor and Microcontrollers", Eastern Company Edition, Prentice Hall of India, New Delhi , 2007.
2. R.S. Gaonkar, 'Microprocessor Architecture Programming and Application', with 8085, Wiley Eastern Ltd., New Delhi, 2013.
3. Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085,8086,8051,McGraw Hill Edu,2013.

REFERENCES:

1. Muhammad Ali Mazidi & Janice Gilli Mazidi, R.D.Kinely 'The 8051 Micro Controller and Embedded Systems', PHI Pearson Education, 5th Indian reprint, 2003.
2. N.Senthil Kumar, M.Saravanan, S.Jeevananthan, 'Microprocessors and Microcontrollers', Oxford,2013.
3. Valder – Perez, "Microcontroller – Fundamentals and Applications with Pic," Yeesdee Publishers, Tayler & Francis, 2013.

ME6701 POWER PLANT ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

- Providing an overview of Power Plants and detailing the role of Mechanical Engineers in their operation and maintenance.

UNIT I COAL BASED THERMAL POWER PLANTS 10

Rankine cycle - improvisations, Layout of modern coal power plant, Super Critical Boilers, FBC Boilers, Turbines, Condensers, Steam & Heat rate, Subsystems of thermal power plants – Fuel and ash handling, Draught system, Feed water treatment. Binary Cycles and Cogeneration systems.

UNIT II DIESEL, GAS TURBINE AND COMBINED CYCLE POWER PLANTS 10

Otto, Diesel, Dual & Brayton Cycle - Analysis & Optimisation. Components of Diesel and Gas Turbine power plants. Combined Cycle Power Plants. Integrated Gasifier based Combined Cycle systems.

UNIT III NUCLEAR POWER PLANTS 7

Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors : B*oiling Water Reactor* (BWR), P*ressurized Water Reactor* (PWR), CANada Deuterium-Uranium reactor (CANDU), Breeder, Gas Cooled and Liquid Metal Cooled Reactors. Safety measures for Nuclear Power plants.

UNIT IV POWER FROM RENEWABLE ENERGY 10

Hydro Electric Power Plants – Classification, Typical Layout and associated components including Turbines. Principle, Construction and working of Wind, Tidal, *Solar* Photo Voltaic (SPV), Solar Thermal, Geo Thermal, Biogas and Fuel Cell power systems.

UNIT V ENERGY, ECONOMIC AND ENVIRONMENTAL ISSUES OF POWER PLANTS 8

Power tariff types, Load distribution parameters, load curve, Comparison of site selection criteria, relative merits & demerits, Capital & Operating Cost of different power plants. Pollution control technologies including Waste Disposal Options for Coal and Nuclear Power Plants.

TOTAL : 45 PERIODS

OUTCOMES:

- Upon completion of this course, the Students can able to understand different types of power plant, and its functions and their flow lines and issues related to them.
- Analyse and solve energy and economic related issues in power sectors.

TEXT BOOK:

1. P.K. Nag, Power Plant Engineering, Tata McGraw – Hill Publishing Company Ltd., Third Edition, 2008.

REFERENCES:

1. M.M. El-Wakil, Power Plant Technology, Tata McGraw – Hill Publishing Company Ltd., 2010.
2. Black & Veatch, Springer, Power Plant Engineering, 1996.
3. Thomas C. Elliott, Kao Chen and Robert C. Swanekamp, Standard Handbook of Power Plant Engineering, Second Edition, McGraw – Hill, 1998.
4. Godfrey Boyle, Renewable energy, Open University, Oxford University Press in association with the Open University, 2004.

EE6503 **POWER ELECTRONICS** **L T P C**
3 0 0 3

OBJECTIVES:

- To get an overview of different types of power semiconductor devices and their switching characteristics.
- To understand the operation, characteristics and performance parameters of controlled rectifiers
- To study the operation, switching techniques and basics topologies of DC-DC switching regulators.
- To learn the different modulation techniques of pulse width modulated inverters and to understand harmonic reduction methods.
- To study the operation of AC voltage controller and various configurations.

UNIT I POWER SEMI-CONDUCTOR DEVICES **9**

Study of switching devices, Diode, SCR,TRIAC, GTO, BJT, MOSFET, IGBT-Static and Dynamic characteristics - Triggering and commutation circuit for SCR- Design of Driver and snubber circuit.

UNIT II PHASE-CONTROLLED CONVERTERS **9**

2-pulse,3-pulse and 6-pulseconverters- performance parameters -Effect of source inductance– Gate Circuit Schemes for Phase Control-Dual converters.

UNIT III DC TO DC CONVERTER **9**

Step-down and step-up chopper-control strategy-Forced commutated chopper-Voltage commutated, Current commutated, Load commutated, Switched mode regulators- Buck, boost, buck- boost converter, Introduction to Resonant Converters.

UNIT IV INVERTERS **9**

Single phase and three phase voltage source inverters(both 120^0modeand 180^0mode)-Voltage& harmonic control--PW M techniques: Sinusoidal PWM, modified sinusoidal PWM - multiple PWM – Introduction to space vector modulation –Current source inverter.

UNIT V AC TO AC CONVERTERS **9**

Single phase and Three phase AC voltage controllers-Control strategy- Power Factor Control – Multistage sequence control -single phase and three phase cyclo converters –Introduction to Matrix converters.

TOTAL:45 PERIODS

OUTCOMES:

- Ability to understand and analyse, linear and digital electronic circuits.

TEXT BOOKS:

1. M.H.Rashid, 'Power Electronics: Circuits, Devices and Applications', Pearson Education, PHI Third Edition, New Delhi, 2004.
2. P.S.Bimbra "Power Electronics" Khanna Publishers, third Edition, 2003.
3. L. Umanand, " Power Electronics Essentials and Applications", Wiley, 2010.

REFERENCES:

1. Joseph Vithayathil,' Power Electronics, Principles and Applications', McGraw Hill Series, 6th Reprint, 2013.
2. Ashfaq Ahmed Power Electronics for Technology Pearson Education, Indian reprint, 2003.
3. Philip T. Krein, "Elements of Power Electronics" Oxford University Press, 2004 Edition.
4. Ned Mohan, Tore. M. Undel and, William. P. Robbins,' Power Electronics: Converters, Applications and Design', John Wiley and sons, third edition,2003.
5. Daniel.W.Hart, "Power Electronics", Indian Edition, Mc Graw Hill, 3rd Print, 2013.
6. M.D. Singh and K.B. Khanchandani, "Power Electronics," Mc Graw Hill India, 2013.

EE6504 ELECTRICAL MACHINES – II **L T P C**
3 1 0 4

OBJECTIVES:

- To impart knowledge on Construction and performance of salient and non – salient type synchronous generators.
- To impart knowledge on Principle of operation and performance of synchronous motor.
- To impart knowledge on Construction, principle of operation and performance of induction machines.
- To impart knowledge on Starting and speed control of three-phase induction motors.
- To impart knowledge on Construction, principle of operation and performance of single phase induction motors and special machines.

UNIT I SYNCHRONOUS GENERATOR **9**

Constructional details – Types of rotors –winding factors- emf equation – Synchronous reactance – Armature reaction – Phasor diagrams of non salient pole synchronous generator connected to infinite bus--Synchronizing and parallel operation – Synchronizing torque -Change of excitation and

mechanical input- Voltage regulation – EMF, MMF, ZPF and A.S.A methods – steady state power-angle characteristics- Two reaction theory -slip test -short circuit transients - Capability Curves

UNIT II SYNCHRONOUS MOTOR 9

Principle of operation – Torque equation – Operation on infinite bus bars - V and Inverted V curves – Power input and power developed equations – Starting methods – Current loci for constant power input, constant excitation and constant power developed-Hunting – natural frequency of oscillations – damper windings- synchronous condenser.

UNIT III THREE PHASE INDUCTION MOTOR 9

Constructional details – Types of rotors –- Principle of operation – Slip -cogging and crawling- Equivalent circuit – Torque-Slip characteristics - Condition for maximum torque – Losses and efficiency – Load test - No load and blocked rotor tests - Circle diagram – Separation of losses – Double cage induction motors -Induction generators – Synchronous induction motor.

UNIT IV STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTOR 9

Need for starting – Types of starters – DOL, Rotor resistance, Autotransformer and Star-delta starters – Speed control – Voltage control, Frequency control and pole changing – Cascaded connection-V/f control – Slip power recovery scheme-Braking of three phase induction motor: Plugging, dynamic braking and regenerative braking.

UNIT V SINGLE PHASE INDUCTION MOTORS AND SPECIAL MACHINES 9

Constructional details of single phase induction motor – Double field revolving theory and operation – Equivalent circuit – No load and blocked rotor test – Performance analysis – Starting methods of single-phase induction motors – Capacitor-start capacitor run Induction motor- Shaded pole induction motor - Linear induction motor – Repulsion motor - Hysteresis motor - AC series motor- Servo motors- Stepper motors – introduction to magnetic levitation systems.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:

- Ability to model and analyze electrical apparatus and their application to power system

TEXT BOOKS:

1. A.E. Fitzgerald, Charles Kingsley, Stephen. D.Umans, 'Electric Machinery', Tata Mc Graw Hill publishing Company Ltd, 2003.
2. D.P. Kothari and I.J. Nagrath, 'Electric Machines', Tata McGraw Hill Publishing Company Ltd, 2002.
3. P.S. Bhimbhra, 'Electrical Machinery', Khanna Publishers, 2003.

REFERENCES:

1. M.N.Bandyopadhyay, Electrical Machines Theory and Practice, PHI Learning PVT LTD., New Delhi, 2009.
2. Charless A. Gross, "Electric /Machines, "CRC Press, 2010.
3. K. Murugesh Kumar, 'Electric Machines', Vikas Publishing House Pvt. Ltd, 2002.
4. Syed A. Nasar, Electric Machines and Power Systems: Volume I, Mcgraw -Hill College; International ed Edition, January 1995.
5. Alexander S. Langsdorf, Theory of Alternating-Current Machinery, Tata McGraw Hill Publications, 2001.

IC6501 **CONTROL SYSTEMS** **L T P C**
3 1 0 4

OBJECTIVES:

- To understand the use of transfer function models for analysis physical systems and introduce the control system components.
- To provide adequate knowledge in the time response of systems and steady state error analysis.
- To accord basic knowledge in obtaining the open loop and closed-loop frequency responses of systems.
- To introduce stability analysis and design of compensators
- To introduce state variable representation of physical systems and study the effect of state feedback

UNIT I SYSTEMS AND THEIR REPRESENTATION 9

Basic elements in control systems – Open and closed loop systems – Electrical analogy of mechanical and thermal systems – Transfer function – Synchros – AC and DC servomotors – Block diagram reduction techniques – Signal flow graphs.

UNIT II TIME RESPONSE 9

Time response – Time domain specifications – Types of test input – I and II order system response – Error coefficients – Generalized error series – Steady state error – Root locus construction- Effects of P, PI, PID modes of feedback control –Time response analysis.

UNIT III FREQUENCY RESPONSE 9

Frequency response – Bode plot – Polar plot – Determination of closed loop response from open loop response - Correlation between frequency domain and time domain specifications- Effect of Lag, lead and lag-lead compensation on frequency response- Analysis.

UNIT IV STABILITY AND COMPENSATOR DESIGN 9

Characteristics equation – Routh Hurwitz criterion – Nyquist stability criterion- Performance criteria – Lag, lead and lag-lead networks – Lag/Lead compensator design using bode plots.

UNIT V STATE VARIABLE ANALYSIS 9

Concept of state variables – State models for linear and time invariant Systems – Solution of state and output equation in controllable canonical form – Concepts of controllability and observability – Effect of state feedback.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:

- Ability to understand and apply basic science, circuit theory, theory control theory Signal processing and apply them to electrical engineering problems.

TEXT BOOKS:

1. M. Gopal, 'Control Systems, Principles and Design', 4th Edition, Tata McGraw Hill, New Delhi, 2012
2. S.K.Bhattacharya, Control System Engineering, 3rd Edition, Pearson, 2013.
3. Dhanesh. N. Manik, Control System, Cengage Learning, 2012.

REFERENCES:

1. Arthur, G.O.Mutambara, Design and Analysis of Control; Systems, CRC Press, 2009.
2. Richard C. Dorf and Robert H. Bishop, " Modern Control Systems", Pearson Prentice Hall, 2012.
3. Benjamin C. Kuo, Automatic Control systems, 7th Edition, PHI, 2010.
4. K. Ogata, 'Modern Control Engineering', 5th edition, PHI, 2012.

5. S.N.Sivanandam, S.N.Deepa, Control System Engineering using Mat Lab, 2nd Edition, Vikas Publishing, 2012.
6. S.Palani, Anoop. K.Jairath, Automatic Control Systems including Mat Lab, Vijay Nicole/ Mcgraw Hill Education, 2013.

EE6511 CONTROL AND INSTRUMENTATION LABORATORY LT P C
0 0 3 2

OBJECTIVES:

To provide knowledge on analysis and design of control system along with basics of instrumentation

LIST OF EXPERIMENTS:

CONTROLSYSTEMS:

1. P, PI and PID controllers
2. Stability Analysis
3. Modeling of Systems – Machines, Sensors and Transducers
4. Design of Lag, Lead and Lag-Lead Compensators
5. Position Control Systems
6. Synchro-Transmitter- Receiver and Characteristics
7. Simulation of Control Systems by Mathematical development tools.

INSTRUMENTATION:

8. Bridge Networks –AC and DC Bridges
9. Dynamics of Sensors/Transducers a. Temperature
   b. Pressure
   c. Displacement
   d. Optical
   e. Strain f. Flow
10. Power and Energy Measurement
11. Signal Conditioning
    a. Instrumentation Amplifier
    b. Analog – Digital and Digital –Analog converters (ADC and DACs)
12. Process Simulation.

TOTAL : 45 PERIODS

GE6674 COMMUNICATION AND SOFT SKILLS- LABORATORY BASED L T P C
0 0 4 2

OBJECTIVES:

To enable learners to,

- Develop their communicative competence in English with specific reference to speaking and listening
- Enhance their ability to communicate effectively in interviews.
- Strengthen their prospects of success in competitive examinations.

UNIT I LISTENING AND SPEAKING SKILLS 12

Conversational skills (formal and informal)- group discussion- making effective presentations using computers, listening/watching interviews conversations, documentaries. Listening to lectures, discussions from TV/ Radio/ Podcast.

UNIT II READING AND WRITING SKILLS 12

Reading different genres of tests ranging from newspapers to creative writing. Writing job applications- cover letter- resume- emails- letters- memos- reports. Writing abstracts- summaries- interpreting visual texts.

UNIT III ENGLISH FOR NATIONAL AND INTERNATIONAL EXAMINATIONS AND PLACEMENTS 12

International English Language Testing System (IELTS) - Test of English as a Foreign Language (TOEFL) - Civil Service(Language related)- Verbal Ability.

UNIT IV INTERVIEW SKILLS 12

Different types of Interview format- answering questions- offering information- mock interviews-body language(paralinguistic features)- articulation of sounds- intonation.

UNIT V SOFT SKILLS 12

Motivation- emotional intelligence-Multiple intelligences- emotional intelligence- managing changes-time management-stress management-leadership straits-team work- career planning - intercultural communication- creative and critical thinking

TOTAL: 60 PERIODS

Teaching Methods:

1. To be totally learner-centric with minimum teacher intervention as the course revolves around practice.
2. Suitable audio/video samples from Podcast/YouTube to be used for illustrative purposes.
3. Portfolio approach for writing to be followed. Learners are to be encouraged to blog, tweet, text and email employing appropriate language.
4. GD/Interview/Role Play/Debate could be conducted off the laboratory (in a regular classroom) but learners are to be exposed to telephonic interview and video conferencing.
5. Learners are to be assigned to read/write/listen/view materials outside the classroom as well for graining proficiency and better participation in the class.

EE6512 **ELECTRICAL MACHINES LABORATORY - II** **LT P C**
0 0 3 2

OBJECTIVES:

To expose the students to the operation of synchronous machines and induction motors and give them experimental skill.

LIST OF EXPERIMENTS:

1. Regulation of three phase alternator by emf and mmf methods.
2. Regulation of three phase alternator by ZPF and ASA methods.
3. Regulation of three phase salient pole alternator by slip test.
4. Measurements of negative sequence and zero sequence impedance of alternators.
5. V and Inverted V curves of Three Phase Synchronous Motor.
6. Load test on three-phase induction motor.
7. No load and blocked rotor test on three-phase induction motor(Determination of equivalent circuit parameters).
8. Separation of No-load losses of three-phase induction motor.
9. Load test on single-phase induction motor.
10. No load and blocked rotor test on single-phase induction motor.
11. Study of Induction motor Starters

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to model and analyze electrical apparatus and their application to power system

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Synchronous Induction motor 3HP – 1 No.
2. DC Shunt Motor Coupled With Three phase Alternator – 4 nos
3. DC Shunt Motor Coupled With Three phase Slip ring Induction motor – 1 No.

EC6651 **COMMUNICATION ENGINEERING** **LT P C**
3 0 0 3

OBJECTIVES:

- To introduce different methods of analog communication and their significance
- To introduce Digital Communication methods for high bit rate transmission
- To introduce the concepts of source and line coding techniques for enhancing rating of transmission of minimizing the errors in transmission.
- To introduce MAC used in communication systems for enhancing the number of users.
- To introduce various media for digital communication

UNIT I **ANALOG COMMUNICATION** **9**

AM – Frequency spectrum – vector representation – power relations – generation of AM – DSB, DSB/SC, SSB, VSB AM Transmitter & Receiver; FM and PM – frequency spectrum – power relations : NBFM & WBFM, Generation of FM and DM, Amstrong method & Reactance modulations : FM & PM frequency.

UNIT II **DIGITAL COMMUNICATION** **9**

Pulse modulations – concepts of sampling and sampling theormes, PAM, PWM, PPM, PTM, quantization and coding : DCM, DM, slope overload error. ADM, DPCM, OOK systems – ASK, FSK, PSK, BSK, QPSK, QAM, MSK, GMSK, applications of Data communication.

UNIT III **SOURCE CODES, LINE CODES & ERROR CONTROL (Qualitative only)** **9**

Primary communication – entropy, properties, BSC, BEC, source coding : Shaum, Fao, Huffman coding : noiseless coding theorum, BW – SNR trade off codes: NRZ, RZ, AMI, HDBP, ABQ, MBnBcodes : Efficiency of transmissions, error control codes and applications: convolutions & block codes.

UNIT IV **MULTIPLE ACCESS TECHNIQUES** **9**

SS&MA techniques : FDMA, TDMA, CDMA, SDMA application in wire and wireless communication : Advantages (merits)

UNIT V **SATELLITE, OPTICAL FIBER – POWERLINE, SCADA** **9**

Orbits : types of satellites : frequency used link establishment, MA techniques used in satellite communication, earth station; aperture actuators used in satellite – Intelsat and Insat: fibers – types: sources, detectors used, digital filters, optical link: power line carrier communications: SCADA

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and analyse, linear and digital electronic circuits.

TEXT BOOKS:

1. Taub & Schiling "Principles of Communication Systems" Tata McGraw Hill 2007.
2. J.Das "Principles of Digital Communication" New Age International, 1986.

REFERENCES:

1. Kennedy and Davis "Electronic Communication Systems" Tata McGraw hill, 4th Edition, 1993.
2. Sklar "Digital Communication Fundamentals and Applications" Pearson Education, 2001.
3. Bary le, Memuschmidt, Digital Communication, Kluwer Publication, 2004.
4. B.P.Lathi "Modern Digital and Analog Communication Systems" Oxford University Press, 1998.

EE6601 **SOLID STATE DRIVES** **L T P C**

3 0 0 3

OBJECTIVES:

- To understand steady state operation and transient dynamics of a motor load system.
- To study and analyze the operation of the converter/chopper fed dc drive, both qualitatively and quantitatively.
- To study and understand the operation and performance of AC motor drives.
- To analyze and design the current and speed controllers for a closed loop solid state DC motor drive.

UNIT I **DRIVE CHARACTERISTICS** **9**

Electric drive – Equations governing motor load dynamics – steady state stability – multi quadrant Dynamics: acceleration, deceleration, starting & stopping – typical load torque characteristics – Selection of motor.

UNIT II **CONVERTER / CHOPPER FED DC MOTOR DRIVE** **9**

Steady state analysis of the single and three phase converter fed separately excited DC motor drive-continuous and discontinuous conduction- Time ratio and current limit control – 4 quadrant operation of converter / chopper fed drive.

UNIT III **INDUCTION MOTOR DRIVES** **9**

Stator voltage control-energy efficient drive-v/f control-constant airgap flux-field weakening mode – voltage / current fed inverter – closed loop control.

UNIT IV **SYNCHRONOUS MOTOR DRIVES** **9**

V/f control and self control of synchronous motor: Margin angle control and power factor control –

permanent magnet synchronous motor.

UNIT V DESIGN OF CONTROLLERS FOR DRIVES **9**

Transfer function for DC motor / load and converter – closed loop control with Current and speed feedback-armature voltage control and field weakening mode – Design of controllers; current controller and speed controller- converter selection and characteristics.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to understand and apply basic science, circuit theory, Electro-magnetic field theory control theory and apply them to electrical engineering problems.

TEXT BOOKS:

1. Gopal K.Dubey, Fundamentals of Electrical Drives, Narosa Publishing House, 1992.
2. Bimal K.Bose. Modern Power Electronics and AC Drives, Pearson Education, 2002.
3. R.Krishnan, Electric Motor & Drives: Modeling, Analysis and Control, Prentice Hall of India, 2001.

REFERENCES:

1. John Hindmarsh and Alasdain Renfrew, “Electrical Machines and Drives System,” Elsevier 2012.
2. Shaahin Felizadeh, “Electric Machines and Drives”, CRC Press(Taylor and Francis Group), 2013.
3. S.K.Pillai, A First course on Electrical Drives, Wiley Eastern Limited, 1993.
4. S. Sivanagaraju, M. Balasubba Reddy, A. Mallikarjuna Prasad “Power semiconductor drives” PHI, 5th printing, 2013.
5. N.K.De., P.K.SEN”Electric drives” PHI, 2012.
6. Vedam Subramanyam, ”Thyristor Control of Electric Drives”, Tata McGraw Hill, 2007.

EE6602 **EMBEDDED SYSTEMS** **L T P C**
3 0 0 3

OBJECTIVES:

- To introduce the Building Blocks of Embedded System
- To Educate in Various Embedded Development Strategies
- To Introduce Bus Communication in processors, Input/output interfacing.
- To impart knowledge in Various processor scheduling algorithms.
- To introduce Basics of Real time operating system and example tutorials to discuss on one real-time operating system tool

UNIT I INTRODUCTION TO EMBEDDED SYSTEMS **9**

Introduction to Embedded Systems – The build process for embedded systems- Structural units in Embedded processor , selection of processor & memory devices- DMA – Memory management methods- Timer and Counting devices, Watchdog Timer, Real Time Clock, In circuit emulator, Target Hardware Debugging.

UNIT II EMBEDDED NETWORKING 9

Embedded Networking: Introduction, I/O Device Ports & Buses- Serial Bus communication protocols - RS232 standard – RS422 – RS485 - CAN Bus -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I^2C) –need for device drivers.

UNIT III EMBEDDED FIRMWARE DEVELOPMENT ENVIRONMENT 9

Embedded Product Development Life Cycle- objectives, different phases of EDLC, Modelling of EDLC; issues in Hardware-software Co-design, Data Flow Graph, state machine model, Sequential Program Model, concurrent Model, object oriented Model.

UNIT IV RTOS BASED EMBEDDED SYSTEM DESIGN 9

Introduction to basic concepts of RTOS- Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non-preemptive scheduling, Task communication-shared memory, message passing-, Inter process Communication – synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance, comparison of Real time Operating systems: Vx Works, ЧC/OS-II, RT Linux.

UNIT V EMBEDDED SYSTEM APPLICATION DEVELOPMENT 9

Case Study of Washing Machine- Automotive Application- Smart card System Application,.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to understand and analyse, linear and digital electronic circuits.

TEXT BOOKS:

1. Rajkamal, 'Embedded System-Architecture, Programming, Design', Mc Graw Hill, 2013.
2. Peckol, "Embedded system Design", John Wiley & Sons,2010
3. Lyla B Das," Embedded Systems-An Integrated Approach", Pearson, 2013

REFERENCES:

1. Shibu. K.V, "Introduction to Embedded Systems", Tata Mcgraw Hill,2009.
2. Elicia White," Making Embedded Systems", O' Reilly Series,SPD,2011.
3. Tammy Noergaard, "Embedded Systems Architecture", Elsevier, 2006.
4. Han-Way Huang, "Embedded system Design Using C8051", Cengage Learning,2009.
5. Rajib Mall "Real-Time systems Theory and Practice" Pearson Education, 2007.

EE6603 POWER SYSTEM OPERATION AND CONTROL L T P C
3 0 0 3

OBJECTIVES:

- To have an overview of power system operation and control.
- To model power-frequency dynamics and to design power-frequency controller.
- To model reactive power-voltage interaction and the control actions to be implemented for maintaining the voltage profile against varying system load.
- To study the economic operation of power system.
- To teach about SCADA and its application for real time operation and control of power systems.

UNIT I INTRODUCTION 9

An overview of power system operation and control - system load variation - load characteristics - load curves and load-duration curve - load factor - diversity factor - Importance of load forecasting and quadratic and exponential curve fitting techniques of forecasting – plant level and system level controls .

UNIT II REAL POWER - FREQUENCY CONTROL 9

Basics of speed governing mechanism and modeling - speed-load characteristics – load sharing between two synchronous machines in parallel - control area concept - LFC control of a single-area system - static and dynamic analysis of uncontrolled and controlled cases - two-area system – modeling - static analysis of uncontrolled case - tie line with frequency bias control - state variable model - integration of economic dispatch control with LFC.

UNIT III REACTIVE POWER–VOLTAGE CONTROL 9

Generation and absorption of reactive power - basics of reactive power control - excitation systems – modeling - static and dynamic analysis - stability compensation - methods of voltage control: tap-changing transformer, SVC (TCR + TSC) and STATCOM – secondary voltage control.

UNIT IV UNIT COMMITMENT AND ECONOMIC DISPATCH 9

Formulation of economic dispatch problem – I/O cost characterization – incremental cost curve - co-ordination equations without and with loss (No derivation of loss coefficients) - solution by direct method and λ-iteration method - statement of unit commitment problem – priority-list method - forward dynamic programming.

UNIT V COMPUTER CONTROL OF POWER SYSTEMS 9

Need for computer control of power systems - concept of energy control centre - functions - system monitoring - data acquisition and control - system hardware configuration – SCADA and EMS functions - network topology - state estimation – WLSE - Contingency Analysis - state transition diagram showing various state transitions and control strategies.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and analyze power system operation, stability, control and protection.

TEXT BOOKS:

1. Olle.I.Elgerd, 'Electric Energy Systems theory - An introduction', Tata McGraw Hill Education Pvt. Ltd., New Delhi, 34th reprint, 2010.
2. Allen. J. Wood and Bruce F. Wollenberg, 'Power Generation, Operation and Control', John Wiley & Sons, Inc., 2003.
3. Abhijit Chakrabarti, Sunita Halder, 'Power System Analysis Operation and Control', PHI learning Pvt. Ltd., New Delhi, Third Edition, 2010.

REFERENCES:
1. Nagrath I.J. and Kothari D.P., 'Modern Power System Analysis', Tata McGraw-Hill, Fourth Edition, 2011.
2. Kundur P., 'Power System Stability and Control, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 10th reprint, 2010.
3. Hadi Saadat, 'Power System Analysis', Tata McGraw Hill Education Pvt. Ltd., New Delhi, 21st reprint, 2010.
4. N.V.Ramana, "Power System Operation and Control," Pearson, 2011.
5. C.A.Gross, "Power System Analysis," Wiley India, 2011.

EE6604 **DESIGN OF ELECTRICAL MACHINES** **LT P C**
3 1 0 4

OBJECTIVES:
- To study mmf calculation and thermal rating of various types of electrical machines.
- To design armature and field systems for D.C. machines.
- To design core, yoke, windings and cooling systems of transformers.
- To design stator and rotor of induction machines.
- To design stator and rotor of synchronous machines and study their thermal behaviour.

UNIT I **INTRODUCTION** **9**

Major considerations in Electrical Machine Design - Electrical Engineering Materials – Space factor – Choice of Specific Electrical and Magnetic loadings - Thermal considerations - Heat flow – Temperature rise and Insulating Materials - Rating of machines – Standard specifications.

UNIT II **DC MACHINES** **9**

Output Equations – Main Dimensions – Choice of Specific Electric and Magnetic Loading - Maganetic Circuits Calculations - Carter's Coefficient - Net length of Iron -Real & Apparent flux densities – Selection of number of poles – Design of Armature – Design of commutator and brushes – performance prediction using design values.

UNIT III **TRANSFORMERS** **9**

Output Equations – Main Dimensions - kVA output for single and three phase transformers – Window space factor – Design of core and winding – Overall dimensions – Operating characteristics – No load current – Temperature rise in Transformers – Design of Tank - Methods of cooling of Transformers.

UNIT IV **INDUCTION MOTORS** **9**

Output equation of Induction motor – Main dimensions – Choice of Average flux density – Length of air gap- Rules for selecting rotor slots of squirrel cage machines – Design of rotor bars & slots – Design of end rings – Design of wound rotor – Magnetic leakage calculations – Leakage reactance of polyphase machines- Magnetizing current - Short circuit current – Operating characteristics- Losses and Efficiency.

UNIT V **SYNCHRONOUS MACHINES** **9**

Output equations – choice of Electrical and Magnetic Loading – Design of salient pole machines – Short circuit ratio – shape of pole face – Armature design – Armature parameters – Estimation of air

gap length – Design of rotor –Design of damper winding – Determination of full load field mmf – Design of field winding – Design of turbo alternators – Rotor design.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:

- Ability to model and analyze electrical apparatus and their application to power system

TEXT BOOKS:

1. Sawhney, A.K., 'A Course in Electrical Machine Design', Dhanpat Rai & Sons, New Delhi, 1984.
2. M.V.Deshpande "Design and Testing of Electrical Machine Design" Wheeler Publications, 2010.

REFERENCES:

1. A.Shanmuga Sundaram, G.Gangadharan, R.Palani 'Electrical Machine Design Data Book', New Age International Pvt. Ltd., Reprint, 2007.
2. R.K.Agarwal " Principles of Electrical Machine Design" Esskay Publications, Delhi, 2002.
3. Sen, S.K., 'Principles of Electrical Machine Designs with Computer Programmes', Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 1987.

EE6611 POWER ELECTRONICS AND DRIVES LABORATORY LT P C

0 0 3 2

OBJECTIVES:

To provide hands on experience with power electronic converter design and testing

LIST OF EXPERIMENTS:

1. Gate Pulse Generation using R,RC and UJT.
2. Characteristics of SCR and Triac
3. Characteristics of MOSFET and IGBT
4. AC to DC half controlled converter
5. AC to DC fully controlled Converter
6. Step down and step up MOSFET based choppers
7. IGBT based single phase PWM inverter
8. IGBT based three phase PWM inverter
9. AC Voltage controller
10. Switched mode power converter.
11. SimulationofPEcircuits(1Φ&3Φsemiconverter,1Φ&3Φfullconverter,dc-dc converters, ac voltage controllers).

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to understand and analyse, linear and digital electronic circuits.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Device characteristics(for SCR, MOSFET, TRIAC and IGBT kit with builtin / discrete power supply and meters) - 2 each

2. SinglephaseSCRbasedhalfcontrolledconverterandfullycontrolledconverteralong with built-in/separate/firing circuit/module and meter – 2 each
3. MOSFET based step up and step down choppers(Built in/ Discrete) – 1 each
4. IGBT based single phase PWM inverter module/Discrete Component – 2
5. IGBT based three phase PWM inverter module/Discrete Component – 2
6. Switched mode power converter module/Discrete Component – 2
7. SCR &TRIAC based 1 phase AC controller along with lamp or rheostat load - 2
8. Cyclo converter kit with firing module –
9. Dual regulated Dc power supply with common ground
10. Cathode ray Oscilloscope –10
11. Isolation Transformer – 5
12. Single phase Auto transformer –3
13. Components (Inductance, Capacitance) 3 set for each
14. Multimeter – 5
15. LCR meter – 3
16. Rheostats of various ranges – 2 sets of 10 value
17. Work tables – 10
18. DC and AC meters of required ranges – 20
19. Component data sheets to be provided

EE6612 MICROPROCESSORS AND MICROCONTROLLERS LABORATORY L T P C
0 0 3 2

OBJECTIVES:

To provide training on programming of microprocessors and microcontrollers and understand the interface requirements.

LIST OF EXPERIMENTS:

1. Simple arithmetic operations: addition / subtraction / multiplication / division.
2. Programming with control instructions:
   (i) Ascending / Descending order, Maximum / Minimum of numbers
   (ii) Programs using Rotate instructions
   (iii) Hex / ASCII / BCD code conversions.

3. Interface Experiments: with 8085
   (i) A/D Interfacing. & D/A Interfacing.
4. Traffic light controller.
5. I/O Port / Serial communication
6. Programming Practices with Simulators/Emulators/open source

7. Read a key ,interface display
8. Demonstration of basic instructions with 8051 Micro controller execution, including:
(i) Conditional jumps, looping
(ii) Calling subroutines.
9.. Programming I/O Port 8051
(i) study on interface with A/D & D/A
(ii) study on interface with DC & AC motor .
10. Mini project development with processors.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to understand and analyse, linear and digital electronic circuits.
- To understand and apply computing platform and software for engineering problems.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Sl.No.	Description of Equipment	Quantity required
1.	8085 Microprocessor Trainer with Power Supply	15
2.	8051 Micro Controller Trainer Kit with power supply	15
3.	8255 Interface board	5
4.	8251 Interface board	5
5.	8259 Interface board	5
6.	8279 Keyboard / Display Interface board	5
7.	8254 timer counter	5
8.	ADC and DAC card	5
9.	AC & DC motor with Controller	5
10.	Traffic Light Control System	5

EE6613 PRESENTATION SKILLS AND TECHNICAL SEMINAR L T P C
0 0 2 1

OBJECTIVES:

- To encourage the students to study advanced engineering developments
- To prepare and present technical reports.
- To encourage the students to use various teaching aids such as over head projectors, power point presentation and demonstrative models.

METHOD OF EVALUATION :

During the seminar session each student is expected to prepare and present a topic on engineering/ technology, for a duration of about 8 to 10 minutes. In a session of three periods per week, 15 students are expected to present the seminar. Each student is expected to present atleast twice during the semester and the student is evaluated based on that. At the end of the semester, he / she can submit a report on his / her topic of seminar and marks are given based on the report. A Faculty

guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also. Evaluation is 100% internal.

TOTAL : 30 PERIODS

OUTCOMES:

- Ability to review, prepare and present technological developments
- Ability to face the placement interviews

EE6701 HIGH VOLTAGE ENGINEERING LT P C
3 0 0 3

OBJECTIVES:

- To understand the various types of over voltages in power system and protection methods.
- Generation of over voltages in laboratories.
- Measurement of over voltages.
- Nature of Breakdown mechanism in solid, liquid and gaseous dielectrics.
- Testing of power apparatus and insulation coordination.

UNIT I OVER VOLTAGES IN ELECTRICAL POWER SYSTEMS 9

Causes of over voltages and its effects on power system – Lightning, switching surges and temporary overvoltages, Corona and its effects – Reflection and Refraction of Travelling waves- Protection against overvoltages.

UNIT II DIELECTRIC BREAKDOWN 9

Gaseous breakdown in uniform and non-uniform fields – Corona discharges – Vacuum breakdown – Conduction and breakdown in pure and commercial liquids, Maintenance of oil Quality – Breakdown mechanisms in solid and composite dielectrics.

UNIT III GENERATION OF HIGH VOLTAGES AND HIGH CURRENTS 9

Generation of High DC, AC, impulse voltages and currents - Triggering and control of impulse generators.

UNIT IV MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS 9

High Resistance with series ammeter - Dividers, Resistance, Capacitance and Mixed dividers - Peak Voltmeter, Generating Voltmeters - Capacitance Voltage Transformers, Electrostatic Voltmeters – Sphere Gaps - High current shunts- Digital techniques in high voltage measurement.

UNIT V HIGH VOLTAGE TESTING & INSULATION COORDINATION 9

High voltage testing of electrical power apparatus as per International and Indian standards – Power frequency, impulse voltage and DC testing of Insulators, circuit breakers, bushing, isolators and transformers- Insulation Coordination.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and analyze power system operation, stability, control and protection.

TEXT BOOKS:

1. S.Naidu and V. Kamaraju, 'High Voltage Engineering', Tata McGraw Hill, Fifth Edition, 2013.
2. E. Kuffel and W.S. Zaengl, J.Kuffel, 'High voltage Engineering fundamentals', Newnes Second

Edition Elsevier , New Delhi, 2005.
3. Subir Ray,' An Introduction to High Voltage Engineering' PHI Learning Private Limited, New Delhi, Second Edition, 2013.

REFERENCES:

1. L.L. Alston, 'High Voltage Technology', Oxford University Press, First Indian Edition, 2011.
2. C.L. Wadhwa, 'High voltage Engineering', New Age International Publishers, Third Edition, 2010.

EE6702 PROTECTION AND SWITCHGEAR L T P C
3 0 0 3

OBJECTIVES:

- To educate the causes of abnormal operating conditions (faults, lightning and switching surges) of the apparatus and system.
- To introduce the characteristics and functions of relays and protection schemes.
- To impart knowledge on apparatus protection
- To introduce static and numerical relays
- To impart knowledge on functioning of circuit breakers

UNIT I PROTECTION SCHEMES 9

Principles and need for protective schemes – nature and causes of faults – types of faults – fault current calculation using symmetrical components – Methods of Neutral grounding – Zones of protection and essential qualities of protection – Protection schemes

UNIT II ELECTROMAGNETIC RELAYS 9

Operating principles of relays - the Universal relay – Torque equation – R-X diagram – Electromagnetic Relays – Overcurrent, Directional, Distance, Differential, Negative sequence and Under frequency relays.

UNIT III APPARATUS PROTECTION 9

Current transformers and Potential transformers and their applications in protection schemes - Protection of transformer, generator, motor, busbars and transmission line.

UNIT IV STATIC RELAYS AND NUMERICAL PROTECTION 9

Static relays – Phase, Amplitude Comparators – Synthesis of various relays using Static comparators – Block diagram of Numerical relays – Overcurrent protection, transformer differential protection, distant protection of transmission lines.

UNIT V CIRCUIT BREAKERS 9

Physics of arcing phenomenon and arc interruption - DC and AC circuit breaking – re-striking voltage and recovery voltage - rate of rise of recovery voltage - resistance switching - current chopping - interruption of capacitive current - Types of circuit breakers – air blast, air break, oil, SF6 and vacuum circuit breakers – comparison of different circuit breakers – Rating and selection of Circuit breakers.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and analyze power system operation, stability, control and protection.

TEXT BOOKS:

1. Sunil S.Rao, 'Switchgear and Protection', Khanna Publishers, New Delhi, 2008.
2. B.Rabindranath and N.Chander, 'Power System Protection and Switchgear', New Age International (P) Ltd., First Edition 2011.
3. M.L.Soni, P.V.Gupta, U.S.Bhatnagar, A.Chakrabarti, 'A Text Book on Power System Engineering', Dhanpat Rai & Co.,1998.

REFERENCES:

1. Badri Ram ,B.H. Vishwakarma, 'Power System Protection and Switchgear', New Age International Pvt Ltd Publishers, Second Edition 2011.
2. Y.G.Paithankar and S.R.Bhide, 'Fundamentals of power system protection', Second Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2010.
3. C.L.Wadhwa, 'Electrical Power Systems', 6th Edition, New Age International (P) Ltd., 2010
4. Ravindra P.Singh, ' Switchgear and Power System Protection', PHI Learning Private Ltd., New Delhi, 2009.
5. Bhavesh Bhalja, R.P. Maheshwari, Nilesh G. Chotani,'Protection and Switchgear' Oxford University Press, 2011.

EE6703 SPECIAL ELECTRICAL MACHINES LT P C
3 0 0 3

OBJECTIVES:

- To impart knowledge on Construction, principle of operation and performance of synchronous reluctance motors.
- To impart knowledge on the Construction, principle of operation, control and performance of stepping motors.
- To impart knowledge on the Construction, principle of operation, control and performance of switched reluctance motors.
- To impart knowledge on the Construction, principle of operation, control and performance of permanent magnet brushless D.C. motors.
- To impart knowledge on the Construction, principle of operation and performance of permanent magnet synchronous motors.

UNIT I SYNCHRONOUS RELUCTANCE MOTORS 9

Constructional features – Types – Axial and Radial flux motors – Operating principles – Variable Reluctance Motors – Voltage and Torque Equations - Phasor diagram - performance characteristics – Applications.

UNIT II STEPPER MOTORS 9

Constructional features – Principle of operation – Variable reluctance motor – Hybrid motor – Single and multi stack configurations – Torque equations – Modes of excitation – Characteristics – Drive circuits – Microprocessor control of stepper motors – Closed loop control-Concept of lead angle-Applications.

UNIT III **SWITCHED RELUCTANCE MOTORS** (SRM) **9**

Constructional features – Rotary and Linear SRM - Principle of operation – Torque production – Steady state performance prediction- Analytical method -Power Converters and their controllers – Methods of Rotor position sensing – Sensor less operation – Characteristics and Closed loop control – Applications.

UNIT IV **PERMANENT MAGNET BRUSHLESS D.C. MOTORS** **9**

Permanent Magnet materials – Minor hysteresis loop and recoil line-Magnetic Characteristics – Permeance coefficient -Principle of operation – Types – Magnetic circuit analysis – EMF and torque equations –Commutation - Power Converter Circuits and their controllers – Motor characteristics and control– Applications.

UNIT V **PERMANENT MAGNET SYNCHRONOUS MOTORS** (PMSM) **9**

Principle of operation – Ideal PMSM – EMF and Torque equations – Armature MMF – Synchronous Reactance – Sine wave motor with practical windings - Phasor diagram – Torque/speed characteristics - Power controllers - Converter Volt-ampere requirements– Applications.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to model and analyze electrical apparatus and their application to power system

TEXT BOOKS:

1. K.Venkataratnam, 'Special Electrical Machines', Universities Press (India) Private Limited, 2008.
2. T.J.E. Miller, 'Brushless Permanent Magnet and Reluctance Motor Drives', Clarendon Press, Oxford, 1989.
3. T. Kenjo, 'Stepping Motors and Their Microprocessor Controls', Clarendon Press London, 1984.

REFERENCES:

1. R.Krishnan, 'Switched Reluctance Motor Drives – Modeling, Simulation, Analysis, Design and Application', CRC Press, New York, 2001.
2. P.P. Aearnley, 'Stepping Motors – A Guide to Motor Theory and Practice', Peter Perengrinus London, 1982.
3. T. Kenjo and S. Nagamori, 'Permanent Magnet and Brushless DC Motors', Clarendon Press, London, 1988.
4. E.G. Janardanan, 'Special electrical machines', PHI learning Private Limited, Delhi, 2014.

MG6851 **PRINCIPLES OF MANAGEMENT** **LT P C**
3 0 0 3

OBJECTIVES:

- To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization.

UNIT I **INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS** **9**

Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, human relations , system and contingency approaches – Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.

UNIT II PLANNING **9**

Nature and purpose of planning – planning process – types of planning – objectives – setting objectives - policies - Planning premises - Strategic Management - Planning Tools and Techniques - Decision making steps and process.

UNIT III ORGANISING **9**

Nature and purpose - Formal and informal organization - organization chart - organization structure - types - Line and staff authority - departmentalization - delegation of authority - centralization and decentralization - Job Design - Human Resource Management - HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management.

UNIT IV DIRECTING **9**

Foundations of individual and group behaviour - motivation - motivation theories - motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication - process of communication - barrier in communication - effective communication - communication and IT.

UNIT V CONTROLLING **9**

System and process of controlling - budgetary and non-budgetary control techniques - use of computers and IT in Management control - Productivity problems and management - control and performance – direct and preventive control – reporting.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of the course, students will be able to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling and have same basic knowledge on international aspect of management

TEXT BOOKS:

1. Stephen P. Robbins & Mary Coulter, " Management", Prentice Hall (India) Pvt. Ltd., 10th Edition, 2009.
2. JAF Stoner, Freeman R.E and Daniel R Gilbert "Management", Pearson Education, 6th Edition, 2004.

REFERENCES:

1. Stephen A. Robbins & David A. Decenzo & Mary Coulter, "Fundamentals of Management" Pearson Education, 7th Edition, 2011.
2. Robert Kreitner & Mamata Mohapatra, " Management", Biztantra, 2008.
3. Harold Koontz & Heinz Weihrich "Essentials of Management" Tata McGraw Hill,1998.
4. Tripathy PC & Reddy PN, "Principles of Management", Tata Mcgraw Hill, 1999.

EE6711 **POWER SYSTEM SIMULATION LABORATORY** **L T P C**
0 0 3 2

OBJECTIVES:

To provide better understanding of power system analysis through digital simulation

LIST OF EXPERIMENTS:

1. Computation of Parameters and Modelling of Transmission Lines
2. Formation of Bus Admittance and Impedance Matrices and Solution of Networks.
3. Load Flow Analysis - I : Solution of load flow and related problems using Gauss-Seidel Method
4. Load Flow Analysis - II: Solution of load flow and related problems using Newton Raphson.
5. Fault Analysis
6. Transient and Small Signal Stability Analysis: Single-Machine Infinite Bus System
7. Transient Stability Analysis of Multi machine Power Systems
8. Electromagnetic Transients in Power Systems
9. Load – Frequency Dynamics of Single- Area and Two-Area Power Systems
10. Economic Dispatch in Power Systems.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and analyze power system operation, stability, control and protection.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Personal computers (Pentium-IV, 80GB, 512 MBRAM) – 25 nos
2. Printer laser- 1 No.
3. Dot matrix- 1 No.
4. Server (Pentium IV, 80GB, 1GBRAM) (High Speed Processor) – 1 No.
5. Software: any power system simulation software - 5 licenses
6. Compliers: C, C++, VB, VC++ - 25 users

EE6712 **COMPREHENSION** **L T P C**
0 0 2 1

OBJECTIVES:

To encourage the students to comprehend the knowledge acquired from the first Semester to Sixth Semester of B.E Degree Course through periodic exercise.

METHOD OF EVALUATION:

The students will be assessed 100% internally through weekly test with objective type questions on all the subject related topics

TOTAL : 30 PERIODS

OUTCOMES:

- Ability to review, prepare and present technological developments

EE6801 ELECTRIC ENERGY GENERATION, UTILIZATION AND CONSERVATION **L T P C**
3 0 0 3

OBJECTIVES:

- To analyze the various concepts behind renewable energy resources.
- To introduce the energy saving concept by different ways of illumination.
- To understand the different methods of electric heating and electric welding.
- To introduce knowledge on Solar Radiation and Solar Energy Collectors
- To introduce concepts of Wind Energy and its utilization

UNIT I ELECTRIC DRIVES AND TRACTION **9**

Fundamentals of electric drive - choice of an electric motor - application of motors for particular services - traction motors - characteristic features of traction motor - systems of railway electrification - electric braking - train movement and energy consumption - traction motor control - track equipment and collection gear.

UNIT II ILLUMINATION **9**

Introduction - definition and meaning of terms used in illumination engineering - classification of light sources - incandescent lamps, sodium vapour lamps, mercury vapour lamps, fluorescent lamps – design of illumination systems - indoor lighting schemes - factory lighting halls - outdoor lighting schemes - flood lighting - street lighting - energy saving lamps, LED.

UNIT III HEATING AND WELDING **9**

Introduction - advantages of electric heating – modes of heat transfer - methods of electric heating - resistance heating - arc furnaces - induction heating - dielectric heating - electric welding – types - resistance welding - arc welding - power supply for arc welding - radiation welding.

UNIT IV SOLAR RADIATION AND SOLAR ENERGY COLLECTORS **9**

Introduction - solar constant - solar radiation at the Earth's surface - solar radiation geometry – estimation of average solar radiation - physical principles of the conversion of solar radiation into heat – flat-plate collectors - transmissivity of cover system - energy balance equation and collector efficiency - concentrating collector - advantages and disadvantages of concentrating collectors - performance analysis of a cylindrical - parabolic concentrating collector – Feedin Invertors.

UNIT V WIND ENERGY **9**

Introduction - basic principles of wind energy conversion - site selection considerations - basic components of a WECS (Wind Energy Conversion System) - Classification of WECS - types of wind Turbines - analysis of aerodynamic forces acting on the blade - performances of wind.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and analyze power system operation, stability, control and protection.
- Ability to handle the engineering aspects of electrical energy generation and utilization.

TEXT BOOKS:

1. N.V. Suryanarayana, "Utilisation of Electric Power", Wiley Eastern Limited, New Age International Limited,1993.
2. J.B.Gupta, "Utilisation Electric power and Electric Traction", S.K.Kataria and Sons, 2000.
3. G.D.Rai, "Non-Conventional Energy Sources", Khanna Publications Ltd., New Delhi, 1997.

REFERENCES:

1. R.K.Rajput, Utilisation of Electric Power, Laxmi publications Private Limited.,2007.

2. H.Partab, Art and Science of Utilisation of Electrical Energy", Dhanpat Rai and Co., New Delhi, 2004.
3. C.L.Wadhwa, "Generation, Distribution and Utilisation of Electrical Energy", New Age International Pvt.Ltd., 2003.
4. S. Sivanagaraju, M. Balasubba Reddy, D. Srilatha,' Generation and Utilization of Electrical Energy', Pearson Education, 2010.
5. Donals L. Steeby,' Alternative Energy Sources and Systems', Cengage Learning, 2012.

EE6811 **PROJECT WORK** **L T P C**
0 0 12 6

OBJECTIVES:

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL: 180 PERIODS

OUTCOMES:

- On Completion of the project work students will be in a position to take up any challenging

EE6002 **POWER SYSTEM TRANSIENTS** **LT P C**
3 0 0 3

OBJECTIVES:

- To study the generation of switching transients and their control using circuit – theoretical concept.
- To study the mechanism of lighting strokes and the production of lighting surges.
- To study the propagation, reflection and refraction of travelling waves.
- To study the impact of voltage transients caused by faults, circuit breaker action, load rejection on integrated power system.

UNIT I **INTRODUCTION AND SURVEY** **9**

Review and importance of the study of transients - causes for transients. RL circuit transient with sine wave excitation - double frequency transients - basic transforms of the RLC circuit transients. Different types of power system transients - effect of transients on power systems – role of the study of transients in system planning.

UNIT II SWITCHING TRANSIENTS 9

Over voltages due to switching transients - resistance switching and the equivalent circuit for interrupting the resistor current - load switching and equivalent circuit - waveforms for transient voltage across the load and the switch - normal and abnormal switching transients. Current suppression - current chopping - effective equivalent circuit. Capacitance switching - effect of source regulation - capacitance switching with a restrike, with multiple restrikes. Illustration for multiple restriking transients - ferro resonance.

UNIT III LIGHTNING TRANSIENTS 9

Review of the theories in the formation of clouds and charge formation - rate of charging of thunder clouds – mechanism of lightning discharges and characteristics of lightning strokes – model for lightning stroke - factors contributing to good line design - protection using ground wires - tower footing resistance - Interaction between lightning and power system.

UNIT IV TRAVELING WAVES ON TRANSMISSION LINE COMPUTATION OF TRANSIENTS 9

Computation of transients - transient response of systems with series and shunt lumped parameters and distributed lines. Traveling wave concept - step response - Bewely's lattice diagram - standing waves and natural frequencies - reflection and refraction of travelling waves.

UNIT V TRANSIENTS IN INTEGRATED POWER SYSTEM 9

The short line and kilometric fault - distribution of voltages in a power system - Line dropping and load rejection - voltage transients on closing and reclosing lines - over voltage induced by faults -switching surges on integrated system Qualitative application of EMTP for transient computation.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and analyze power system operation, stability, control and protection.

TEXT BOOKS:

1. Allan Greenwood, 'Electrical Transients in Power Systems', Wiley Inter Science, New York, 2nd Edition, 1991.
2. Pritindra Chowdhari, "Electromagnetic transients in Power System", John Wiley and Sons Inc., Second Edition, 2009.
3. C.S. Indulkar, D.P.Kothari, K. Ramalingam, 'Power System Transients – A statistical approach', PHI Learning Private Limited, Second Edition, 2010.

REFERENCES:

1. M.S.Naidu and V.Kamaraju, 'High Voltage Engineering', Tata McGraw Hill, Fifth Edition, 2013.
2. R.D. Begamudre, 'Extra High Voltage AC Transmission Engineering', Wiley Eastern Limited, 1986.
3. Y.Hase, Handbook of Power System Engineering," Wiley India, 2012.
4. J.L.Kirtley, "Electric Power Principles, Sources, Conversion, Distribution and use," Wiley, 2012.

EI6704	BIOMEDICAL INSTRUMENTATION	L T P C 3 0 0 3

OBJECTIVES:

- To Introduce Fundamentals of Biomedical Engineering
- To study the communication mechanics in a biomedical system with few examples
- To study measurement of certain important electrical and non-electrical parameters
- To understand the basic principles in imaging techniques
- To have a basic knowledge in life assisting and therapeutic devices

UNIT I FUNDAMENTALS OF BIOMEDICAL ENGINEERING 9

Cell and its structure – Resting and Action Potential – Nervous system and its fundamentals - Basic components of a biomedical system- Cardiovascular systems- Respiratory systems -Kidney and blood flow - Biomechanics of bone - Biomechanics of soft tissues - Basic mechanics of spinal column and limbs -Physiological signals and transducers - Transducers – selection criteria – Piezo electric, ultrasonic transducers - Temperature measurements - Fibre optic temperature sensors.

UNIT II NON ELECTRICAL PARAMETERS MEASUREMENT AND DIAGNOSTIC PROCEDURES 9

Measurement of blood pressure - Cardiac output - Heart rate - Heart sound - Pulmonary function measurements – spirometer – Photo Plethysmography, Body Plethysmography – Blood Gas analysers, pH of blood -measurement of blood pCO2, pO2, finger-tip oxymeter - ESR, GSR measurements.

UNIT III ELECTRICAL PARAMETERS ACQUISITION AND ANALYSIS 9

Electrodes – Limb electrodes -floating electrodes – pregelled disposable electrodes - Micro, needle and surface electrodes – Amplifiers, Preamplifiers, differential amplifiers, chopper amplifiers – Isolation amplifier - ECG – EEG – EMG – ERG – Lead systems and recording methods – Typical waveforms - Electrical safety in medical environment, shock hazards – leakage current-Instruments for checking safety parameters of biomedical equipments.

UNIT IV IMAGING MODALITIES AND ANALYSIS 9

Radio graphic and fluoroscopic techniques – Computer tomography – MRI – Ultrasonography – Endoscopy – Thermography -Different types of biotelemetry systems - Retinal Imaging - Imaging application in Biometric systems - Analysis of digital images.

UNIT V LIFE ASSISTING, THERAPEUTIC AND ROBOTIC DEVICES 9

Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators – Diathermy – Heart – Lung machine – Audio meters – Dialysers – Lithotripsy - ICCU patient monitoring system - Nano Robots - Robotic surgery – Advanced 3D surgical techniques- Orthopedic prostheses fixation.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to understand and analyze Instrumentation systems and their applications to various industries.

TEXT BOOKS:

1. Leslie Cromwell, Biomedical Instrumentation and Measurement, Prentice hall of India, New Delhi, 2007.
2. Joseph J.carr and John M. Brown, Introduction to Biomedical Equipment Technology, John Wiley and sons, New York, 4th Edition, 2012.

3. Khandpur R.S, Handbook of Biomedical Instrumentation, , Tata McGraw-Hill, New Delhi, 2nd Edition, 2003.

REFERENCES:

1. John G. Webster, Medical Instrumentation Application and Design, John Wiley and sons, New York, 1998.
2. Duane Knudson, Fundamentals of Biomechanics, Springer, 2nd Edition, 2007.
3. Suh, Sang, Gurupur, Varadraj P., Tanik, Murat M., Health Care Systems, Technology and Techniques, Springer, 1st Edition, 2011.
4. Ed. Joseph D. Bronzino, The Biomedical Engineering Hand Book, Third Edition, Boca Raton, CRC Press LLC, 2006.
5. M.Arumugam, 'Bio-Medical Instrumentation', Anuradha Agencies, 2003.

EE6004 FLEXIBLE AC TRANSMISSION SYSTEMS L T P C 3 0 0 3

OBJECTIVES:

- To introduce the reactive power control techniques
- To educate on static VAR compensators and their applications
- To provide knowledge on Thyristor controlled series capacitors
- To educate on STATCOM devices
- To provide knowledge on FACTS controllers

UNIT I INTRODUCTION 9

Reactive power control in electrical power transmission lines -Uncompensated transmission line - series compensation – Basic concepts of Static Var Compensator (SVC) – Thyristor Controlled Series capacitor (TCSC) – Unified power flow controller (UPFC).

UNIT II STATIC VAR COMPENSATOR (SVC) AND APPLICATIONS 9

Voltage control by SVC – Advantages of slope in dynamic characteristics – Influence of SVC on system voltage – Design of SVC voltage regulator –Modelling of SVC for power flow and fast transient stability – Applications: Enhancement of transient stability – Steady state power transfer – Enhancement of power system damping.

UNIT III THYRISTOR CONTROLLED SERIES CAPACITOR (TCSC) AND APPLICATIONS 9

Operation of the TCSC – Different modes of operation – Modelling of TCSC – Variable reactance model – Modelling for Power Flow and stability studies. Applications: Improvement of the system stability limit – Enhancement of system damping.

UNIT IV VOLTAGE SOURCE CONVERTER BASED FACTS CONTROLLERS 9

Static Synchronous Compensator (STATCOM) – Principle of operation – V-I Characteristics. Applications: Steady state power transfer-enhancement of transient stability - prevention of voltage instability. SSSC-operation of SSSC and the control of power flow –modelling of SSSC in load flow and transient stability studies.

UNIT V CO-ORDINATION OF FACTS CONTROLLERS 9

Controller interactions – SVC – SVC interaction – Co-ordination of multiple controllers using linear control techniques – Control coordination using genetic algorithms.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and analyze power system operation, stability, control and protection.

TEXT BOOKS:

1. R.Mohan Mathur, Rajiv K.Varma, "Thyristor – Based Facts Controllers for Electrical Transmission Systems", IEEE press and John Wiley & Sons, Inc, 2002.
2. Narain G. Hingorani, "Understanding FACTS -Concepts and Technology of Flexible AC Transmission Systems", Standard Publishers Distributors, Delhi- 110 006, 2011.
3. K.R.Padiyar," FACTS Controllers in Power Transmission and Distribution", New Age International(P) Limited, Publishers, New Delhi, 2008.

REFERENCES:

1. A.T.John, "Flexible A.C. Transmission Systems", Institution of Electrical and Electronic Engineers (IEEE), 1999.
2. V.K.Sood,HVDC and FACTS controllers – Applications of Static Converters in Power System, APRIL 2004 , Kluwer Academic Publishers, 2004.
3. Xiao – Ping Zang, Christian Rehtanz and Bikash Pal, "Flexible AC Transmission System: Modelling and Control" Springer, 2012.

EE6008 MICROCONTROLLER BASED SYSTEM DESIGN L T P C
3 0 0 3

OBJECTIVES:

- To introduce the architecture of PIC microcontroller
- To educate on use of interrupts and timers
- To educate on the peripheral devices for data communication and transfer
- To introduce the functional blocks of ARM processor
- To educate on the architecture of ARM processors

UNIT I INTRODUCTION TO PIC MICROCONTROLLERc 9

Introduction to PIC Microcontroller-PIC 16C6x and PIC16C7x Architecture-PIC16cxx-– Pipelining - Program Memory considerations – Register File Structure - Instruction Set - Addressing modes - Simple Operations.

UNIT II INTERRUPTS AND TIMER 9

PIC micro controller Interrupts- External Interrupts-Interrupt Programming-Loop time subroutine - Timers-Timer Programming- Front panel I/O-Soft Keys- State machines and key switches- Display of Constant and Variable strings.

UNIT III PERIPHERALS AND INTERFACING 9

I^2C Bus for Peripherals Chip Access- Bus operation-Bus subroutines- Serial EEPROM–Analog to

Digital Converter-UART-Baud rate selection-Data handling circuit-Initialization - LCD and keyboard Interfacing -ADC, DAC, and Sensor Interfacing.

UNIT IV INTRODUCTION TO ARM PROCESSOR 9

ARM Architecture –ARM programmer's model –ARM Development tools- Memory Hierarchy –ARM Assembly Language Programming-Simple Examples-Architectural Support for Operating systems.

UNIT V ARM ORGANIZATION 9

3-Stage Pipeline ARM Organization- 5-Stage Pipeline ARM Organization-ARM Instruction Execution- ARM Implementation- ARM Instruction Set- ARM coprocessor interface- Architectural support for High Level Languages – Embedded ARM Applications.

TOTAL: 45 PERIODS

OUTCOMES:

- To understand and apply computing platform and software for engineering problems.
- To understand ethical issues, environmental impact and acquire management skills.

TEXT BOOKS:

1. Peatman,J.B., "Design with PIC Micro Controllers"PearsonEducation,3rd Edition, 2004.
2. Furber,S., "ARM System on Chip Architecture" Addison Wesley trade Computer Publication, 2000.

REFERENCE:

1. Mazidi, M.A.,"PIC Microcontroller" Rollin Mckinlay, Danny causey Printice Hall of India, 2007.

EE6009 POWER ELECTRONICS FOR RENEWABLE ENERGY SYSTEMS LT P C 3 0 0 3

OBJECTIVES:

- To Provide knowledge about the stand alone and grid connected renewable energy systems.
- To equip with required skills to derive the criteria for the design of power converters for renewable energy applications.
- To analyse and comprehend the various operating modes of wind electrical generators and solar energy systems.
- To design different power converters namely AC to DC, DC to DC and AC to AC converters for renewable energy systems.
- To develop maximum power point tracking algorithms.

UNIT I INTRODUCTION 9

Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment (cost-GHG Emission) - Qualitative study of different renewable energy resources: Solar, wind, ocean, Biomass, Fuel cell, Hydrogen energy systems and hybrid renewable energy systems.

UNIT II ELECTRICAL MACHINES FOR RENEWABLE ENERGY CONVERSION 9

Reference theory fundamentals-principle of operation and analysis: IG, PMSG, SCIG and DFIG.

UNIT III POWER CONVERTERS **9**

Solar: Block diagram of solar photo voltaic system -Principle of operation: line commutated converters (inversion-mode) - Boost and buck-boost converters- selection of inverter, battery sizing, array sizing Wind: Three phase AC voltage controllers- AC-DC-AC converters: uncontrolled rectifiers, PWM Inverters, Grid Interactive Inverters-matrix converters.

UNIT IV ANALYSIS OF WIND AND PV SYSTEMS **9**

Stand alone operation of fixed and variable speed wind energy conversion systems and solar system-Grid connection Issues -Grid integrated PMSG, SCIG Based WECS, grid Integrated solar system

UNIT V HYBRID RENEWABLE ENERGY SYSTEMS **9**

Need for Hybrid Systems- Range and type of Hybrid systems- Case studies of Wind-PV Maximum Power Point Tracking (MPPT).

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and analyze power system operation, stability, control and protection.
- Ability to handle the engineering aspects of electrical energy generation and utilization.

TEXT BOOK:

1. S. N. Bhadra, D.Kastha, S.Banerjee, "Wind Electrical Systems", Oxford University Press, 2005.
2. B.H.Khan Non-conventional Energy sources Tata McGraw-hill Publishing Company, New Delhi,2009.

REFERENCES:

1. Rashid .M. H "power electronics Hand book", Academic press, 2001.
2. Ion Boldea, "Variable speed generators", Taylor & Francis group, 2006.
3. Rai. G.D, "Non conventional energy sources", Khanna publishes, 1993.
4. Gray, L. Johnson, "Wind energy system", prentice hall linc, 1995.
5. Andrzej M. Trzynnadlowski, 'Introduction to Modern Power Electronics', Second edition, wiley India Pvt. Ltd, 2012.

GE6075 PROFESSIONAL ETHICS IN ENGINEERING **L T P C**
3 0 0 3

OBJECTIVES:

- To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

UNIT I HUMAN VALUES **10**

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

UNIT II ENGINEERING ETHICS **9**

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral

Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as Experimentation – Engineers as responsible Experimenters - Codes of Ethics – A Balanced Outlook on Law.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

UNIT V GLOBAL ISSUES 8

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society.

TEXT BOOKS:

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

REFERENCES:

1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009.
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.
5. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd.,New Delhi, 2013.
6. World Community Service Centre, ' Value Education', Vethathiri publications, Erode, 2011.

Web sources:

1. www.onlineethics.org
2. www.nspe.org
3. www.globalethics.org
4. www.ethics.org